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THE ISLAND OF DOMINICA.

BY F. M. ENDLICH.

DOMINICA has always been veiled in a halo of mystery. Vague rumors of "smoking mountains," of springs flowing "liquid sulphur," and of caverns of prodigious dimensions have invested it with more than ordinary interest.

The island was discovered by Columbus on his second westward voyage in 1493. It belongs to the "Windward Group," the whole of which form a portion of a circle directly east of the Caribbean sea. Geographically Dominica is located about at N. lat. 15°, and 61° long. W. of Greenwich, and its climate, consequently, is subtropical. Without entering into details, which here would carry us beyond our limits, it may be said that the entire Windward Group belongs to one geological system. Generally speaking we may regard these islands—excepting Antigua, Barbadoes and Trinidad—as the highest remaining portions of an extensive eruption, the age of which falls near or into the Eocene period. From their orographic character, as well as from their relative position, the temptation is great to consider them the projecting points of the eastern side of one huge, serrated crater-rim. Detailed observations are too meagre as yet, however, to attempt the establishment of any such hypothesis. Lithologically speaking the erupted material shown on Dominica strikingly resembles that of the southern Wasatch range. Even in special arrangement of the trachytic series the analogy is remarkable. It is furthermore borne out, on this and other islands, by the general contours of elevations, and by the similarity of the effects produced by extensive erosion.

Rising abruptly from the sea, the shores of Dominica afford

comparatively few landing places, and unless a shelving beach can be found, the boat may not unfrequently be swamped in an attempt at landing. Owing to the character of the rocks composing the body of the island, erosive action has been productive of varied results. The immediate base is composed of hard, compact sanidine-trachyte; overlying occurs a series of easily decomposing conglomerates, while the higher portions are again formed by trachyte. In giving these facts, it may be stated that the southern end of the island is spoken of. Towards the high interior and north, but few explorations have been accomplished. Wherever the more easily yielding conglomerates have been attacked by erosive agents, almost vertical walls and narrow gorges are found. Steep slopes are not wanting in the trachytes proper, but they seem to be owing less, perhaps, to erosion than to be the expression of original contour.

Towards the interior the highest mountain reaches an absolute elevation of 5500 feet; within a very few miles of shore, however, 3000 to 3500 feet are attained by a number of peaks. It would be difficult to imagine any more beautiful spot than the southern end of Dominica. Combined with outlines which resemble the rigid stability of Alpine scenery is the luxuriant, sub-tropical flora. An abundance of moisture, equable temperature and absence of the destructive hand of civilization allow full scope for the development of plant life, and have preserved for our admiration a region which cannot fail to call forth enthusiasm. Few sights can be more charming than that of a high, vertical wall clothed throughout with abundant vegetation, exhibiting numerous shades of vivid green. The Roseau river is the most important watercourse of the island. It heads in the higher mountains, flows in a westerly direction, forms a fine waterfall near Laudat, and enters the sea on the leeward side of Dominica at the main port, the town of Roseau.

From the earliest days, since its discovery, Dominica has been a bone of contention between England and France. Ample fortifications, now allowed to decay, speak of the importance which each nation attached to its possession. By the treaty of Fontainebleau it was ceded to Great Britain, but in 1802 was again recovered by France. Finally, in 1814, the former power once more added it to her list of colonies, and has retained it since that time. At the time of its discovery, and for many years after,

Dominica was one of the favorite resorts of the Caribs. This warlike nation here found mountains and water, fish in plenty and fruits in the valleys. From their strongholds in wild fastnesses they more than once issued upon aggressive warfare and severely harassed the settlers of neighboring islands. In the course of years, however, the Caribs have become greatly reduced in numbers, until to-day there is but a mere handful remaining. It is certainly a subject for serious reflection to note the almost complete extermination of a once powerful people by the advance of civilized measures and by superior instruments of aggressive warfare. In view of our own vexed Indian question we may feel inclined to allow personal or national interests to warp judgment or to subvert justice. When, however, the same spectacle is seen from the standpoint of an unimpassioned observer, it assumes a totally different aspect. Dominica and Trinidad are said to contain the last surviving Caribs. On the former island perhaps one thousand may still be living, on the latter not so large a number. Secluded in the mountains of the interior, they are but rarely seen at the settlements. Chivalrous as they formerly were, they have retained to some extent their tribal characteristics of veneration for hereditary and accidental authority and good treatment of their women. These latter have been accustomed to wait upon the "lords of creation" most assiduously, and are rewarded by respect and far more consideration than is usually found among savages. In spite of former cannibalism the Caribs have often shown traits of greatness and magnanimity. At present they occupy a reservation set apart by the government. Peaceably passing their time, they devote their energies to the manufacture of exceedingly tasteful baskets. Double plaiting renders the latter waterproof, and the careful work bestowed upon them is recognized by the numerous uses to which they are put.

In physical appearance these people closely resemble the nobler tribes of our North American Indians; long, straight, black hair falls down over their shoulders; the cheekbones are prominent, nose flattened somewhat, mouth broad and chin massive. Much lighter than the negro population, the color of their skin is yellow to brown. The influence of intermarriage between negro and Carib is plainly perceptible in their descendants. A decided lightening of color, an improvement in features and stature as well as decreased curliness of the hair, denote the pres-

ence of blood which for many years controlled the Windward islands. Many of the girls belonging to this class, who may be found some distance away from the coast, are really quite prepossessing in appearance.

A total population of about 26,000, of which Roseau claims 3000, is ascribed to the island. As might be expected, the constant change of ruling power has had a detrimental effect upon the language spoken by the present population. Defying alike the Parisian and the Englishman, a French patôis is used as the means of lingual communication. Indolence in properly framing words on the part of the negro inhabitants, and perhaps an admixture of some Carib phrases or intonations have rendered it difficult for any one but a resident to understand what is spoken. Very few Caucasians are living on Dominica, as the mountainous character of the colony forbids extensive enterprises. Coffee was introduced, during the last century, from Martinique, and was formerly largely cultivated. Recently, however, an insect has attacked the delicate leaf and destroyed the plants. Experimentally the Liberian coffee-plant has been introduced, and it is hoped that its thick, hardy leaf may successfully withstand the ravages to which the other has succumbed. Limes are raised in great quantities, and have become so thoroughly acclimated that they flourish without requiring any particular attention. Citric acid is manufactured from them and exported. One of the staples is sugar, but the annual production does not exceed a few thousand tons.

From the appearance of the town of Roseau, some inferences may be drawn as to the struggles which were made for possession of the island in times gone by. A dyke, capable of being fortified, protects the water front, while forts, located on the "Mornes" near the town, were destined to keep at bay the invading foe. True, to-day, all of the elaborate defences would speedily fall before the heavy armament of a man-of-war, but at the period of their usefulness they were sufficiently formidable. As the inhabitants are mainly negroes, the town does not present an imposing array of fine structures. Small, wooden huts, thatched in part, protect their families from rain and storms. Illustrating the good taste shown on all these islands, there is a "Public Garden" near the town; fountains cool the air, and conveniently placed seats invite the seeker after shade and the admirer of scenic beauty.

During our stay on the island (February, 1880), we had occa-

sion to visit several points of interest, thanks to the courtesy of gentlemen living there, and the kind offices of Dr. Brown, of Princeton. Prominent among the "mysteries" of Dominica, the "Boiling lake" and the "Soufreurs" have always held their place. The latter are located near the extreme southern end of the island. Leaving Roseau early in the morning, we were pulled along the coast for six miles by four strong oars. On account of the difficulty in landing at some localities, the boats are without rudders. Their place is supplied by a steersman who ably directs the course by means of a short paddle. Boats used by the negroes are built in the shape of canoes, and are partly sharp-keeled dug-outs, the sides being boarded to increase the depth. After we had landed, a very warm climb brought us to the first appearance of chemical changes in the rocks. The feldspathic constituents of the trachyte were thoroughly decomposed, the ground white and dusty with but little vegetation. Some search revealed a number of cavities in the altered material, which were lined or filled with beautiful crystals of sulphur. Although the surface of this decomposed area showed a normal temperature, this increased so rapidly with depth, that at little more than a foot it was unbearable to the touch. Small streams in the vicinity were found to measure 45° C., and the water evidently carried ferric sulphate and alum in solution. Ascending higher, through tall weeds, and plucking guavas on the way, we observed a narrow gully in a rocky mountain side, whence steam was issuing in dense volume. It was a matter of some difficulty to cross a ravine which separated us from this point of greatest chemical activity. Here our colored guides deserted us. Not that their guidance was in the least valuable, but we wanted them to carry specimens. No persuasion, no threat could induce them to follow us to the place where, in their opinion, evil spirits resided. "*They* will throw rocks at you," was their only reply, accompanied by an obstinate negative shake of the head. Who "they" were could not clearly be made out. A prevalent popular superstition regarding evil-minded "mountain spirits," furnished us a clew, however, as to the identity of undefinable enemies. Once within the active region of the Soufreurs it became necessary to be cautious in our movements. The ground was treacherous and of about 60° C. temperature. Small openings lined with crystals of sulphur, steadily emitted sulphurous

gases. At some places it became difficult to breathe, so dense was the volume. After passing over about quarter of a square mile, densely studded with fumaroles, we entered the gorge seen from a distance. Steep, slippery slopes of partly decomposed trachytes here enclosed a narrow stream of water which was found to be heated nearly to the boiling point. Sulphuretted hydrogen was present in great quantities, and hot steam-jets attacked us from the most unexpected quarters. Along the rock-walls we found a number of openings, sometimes nearly half a foot in diameter, from which either steam or gas issued.

> "And it bubbles and seethes, and it hisses and roars,
> As when fire is with water commix'd and contending,"

truly describes what we encountered while slowly climbing upward in the gully. From the bottom, through narrow crevices, by way of cylindrical openings, all around us, steam and gas threatened to bar farther progress. In the bed of the hot creek the water presented an appearance of violent boiling, owing to the rapid emission of large quantities of gas. So thick was the steam at this point that it began to interfere with respiration, and at times our surroundings were entirely shut out from view for several minutes. A large percentage of mineral constituents in the water rendered it totally unfit to drink, even when cooled. Ascending farther in the gorge, escape from which was negatived by barren walls on either side, we finally reached an elevation of about 1200 feet above sea level. Here we found the water cold again, trickling in small streamlets over the rocks. We had escaped from the region of gas and steam and had passed, at the same time, the upper limit of present chemical action. Complete metamorphosis, produced by long-continued decomposition, had placed these rocks beyond the influence of atmospheric agents. Burned out, not now taking part in the phenomena of the immediate vicinity, they remain as mute witnesses of the forces which there must have been at work for ages.

To our satisfaction we were enabled to find in some fragments of fresh and partly decomposed trachyte, the solution of the striking scenes witnessed. Minute crystals or irregular fragments of pyrite impregnate the rock throughout a definite zone. In weight the quantity of this pyrite may amount to about twenty per cent. Moisture in conjunction with atmospheric air will readily decompose this mineral, a process which is accompanied

by generation of heat. Such action will be facilitated and accelerated by the extremely small size of the individual pyritic particles. The postulated reagents are abundantly supplied at the locality in question. In addition to the ferric compound the feldspathic portions of the trachyte are attacked, yield to altering agents, and by increase of volume accompanying chemical change, add their share to the generation of heat. At the same time the decomposing mass is physically disintegrated and then easily removed by natural causes, thus permitting a repetition of the same process, until the supply of unstable chemical compounds may become exhausted. Irregularities of either chemical or physical character within trachytic rocks are by no means of rare occurrence. Should their nature be such as to yield more readily to active reagents than the portions surrounding them, decomposition will progress at a higher rate of speed along certain lines or in certain directions. Thus vents may be formed which besides serving as outlets for gases and liquids, will allow fresh supplies of moisture and air to reach points as yet comparatively intact.

Returning to our darkies we found them unfeignedly surprised to see us still alive, but they evidently concluded that we were reserved for some fate even worse than "having rocks thrown at us."

"Wotten Waven" is another point deserving of special study. A morning ride along the left bank of the Roseau, which led through flourishing lime plantations, brought us to the undisturbed timbered slopes of a subtropical zone. Huge tree ferns overshadowed the narrow path cut into a steep face of trachytic conglomerate, over which we were gradually winding our way upward. It would be impossible to furnish a pen picture capable of giving even a faint idea of the beauty inherent in such a forest. The cool moist atmosphere is refreshing, and every step taken forces admiration from those whose eyes are accustomed to the more sombre grandeur of northern climes. A column of steam slowly wreathing skyward betrayed the presence of Wotten Waven. These "thermal springs" lie about 1600 feet above sea level, but not within pyritiferous trachyte. A short distance from the timber edge we found a creek flowing cold water. Following this down, the first hot springs were soon encountered. Here the water issued from small apertures in trachytic rock

which showed but little decomposition on the surface. Varying temperature, ranging from 85° C. to boiling point, was observed, while the water of the creek measured 68° C. But a few yards to the right, a narrow gully ran off from the creek, ending abruptly in a vertical wall, the lower portions of which were composed of trachyte. In the latter an almost circular opening, about two feet in diameter, led to regions unknown. Standing in front of this opening a regular pulsation within was observed. So far as could be seen, it was the mouth of a somewhat extended cavity into which water rushed simultaneously, at nearly regular intervals, from the two sides parallel with the trend of the ravine. If a comparison be attempted, the total effect might be likened to the noise produced by a ship's engine, accompanied by a similar though slighter tremor. Four pulsations occurred on an average during every seven seconds, and the fifth ejected a large mass of water through the opening. This main "spring" of Wotten Waven must therefore be regarded as a *geyser*. On account of the slippery character of the rocks and the imminent risk of being scalded, the temperature could not be obtained at the moment of emission. As the water flowed off it measured 98° C. Besides this large geyser, numerous small ones occur here, all, however, sending their water in lateral directions, not vertically. In addition to the rock openings ejecting water, there were many from which steam issued. Sometimes this was not visible at the immediate mouth and it became a matter of discrimination as to the selection of standing places. Taking the temperature of several of these jets, we found a maximum of 102° C. Noticeable is the total absence of sulphuretted hydrogen. While at the Soufreurs all the silver we carried with us almost instantly turned black, we could here find no point where bright coins would be at all affected.

Although in a general way the sources of heat are due to the same causes at Wotten Waven as at the Soufreurs, some differences were found. Decomposition is the main factor, but in this instance pyrite is not the material most violently affected. Small quantities of the mineral certainly occur, and it is quite possible that its presence in larger proportion may originally have initiated the process of chemical changes. At this locality the trachytes contain a large percentage of soda feldspar (oligoclase). This is rapidly decomposing, and by the chemical reaction itself, as well

as by the considerable increase in volume incident thereto, heat is produced. In several instances, where the same changes were going on in rocks containing oligoclase, we have found thermal springs in the immediate vicinity. While decomposition of pyrite is more rapid, it does not extend so far from the surface into the rocks as that of the feldspar. In connection herewith it may be mentioned that the waters of Wotten Waven hold an exceptionally large amount of alumina in solution. In spite of the diminutive size of the majority of the geysers, the quantity of water delivered is considerable. As it nearly all flows off, a very large supply must be furnished by percolation, or by entrance through fissures and along subterranean watercourses.

On January 4, 1880, the inhabitants of Roseau had cause to feel somewhat alarmed. Taking into consideration the mysterious legends as to volcanic activity on the island, it will readily be understood that the appearance of a huge, dark cloud over the town shortly before noon of a clear day, might awaken some apprehensions. More so, however, when that cloud began to "rain down" fine particles of gray, mineral-like material which soon changed the green foliage of all vegetation to its own color. Pompeii and Herculaneum saw the initiation of their destruction in a similar cloud. So far as could be determined by cool observers, among whom Dr. Nichols of Roseau was prominent, the cloud extended for a distance of about eight miles beyond the town and then was lost, going seaward. Even in the latter part of February the finely divided "ash" could be found on many plants. It consisted of very minute fragments of trachytic rock and small crystals and particles of pyrite. The general impression was that a volcanic eruption had taken place at "Boiling Lake."

Neither definite detonations were heard nor seismic disturbances felt by the more critical observers. A low rumbling noise seems to have preceded the appearance of the cloud. Several venturesome explorers determined to investigate matters, but were obliged to return without results, as all access to the lake had been barred by dislodged rocks and earth. During our stay at Roseau a party was organized to visit the lake, and a new road was cut through the forest. Numerous colored attendants, whose climbing qualities and endurance we could not but admire, transported baggage and provisions. Reaching a point several miles

beyond Laudat, we were obliged to relinquish our riding animals and proceed on foot. Wet and slippery the newly cut path followed the sharp crest of a narrow ridge until it reached an absolute elevation of 3200 feet. From here the view was overpowering. Before us lay miles of mountain slopes, utterly denuded of vegetation. Dull gray was the color of the entire surface, and the broken stumps of once gigantic trees spoke eloquently of the terrific force which had laid in desolate waste what but two months before had been a dense primeval forest. Behind us was the beautiful valley of the Roseau, the wooded mountains skirting it and withal an expression of serene repose. To our right steam was fitfully issuing from a crater-like depression, to the left rose a majestic column of white steam from Boiling lake.

We descended a very steep slope and found the "erupted" material to consist of broken and disintegrated fragments of trachyte thoroughly impregnated with pyrite. In other words, we had before us fresh rocks which were analogous to those we found decomposed at the Soufreur and identical with the "ash" which had fallen at Roseau. By far the greater portion of the mass was reduced in size so as to pass through a twenty-mesh sieve. Boulders weighing several hundred pounds were not wanting, however. Arrived at the rivulet at the end of the mountain slope, we found the water to be warm. With the limited amount of time at our command, it was impossible for us to visit the right-hand depression, so we turned our steps towards the lake. The former was the scene of greatest activity, and the place from which the dislodged rock material had issued. Recent disturbances had rendered access so precarious, however, that it would have been necessary to spend more time than we could afford in effecting an entrance to the bottom of the "crater." An inky black creek was crossed shortly, and but a few yards beyond it one of milky whiteness running parallel. Both were warm, about 60° C. Probably the presence of iron sulphides accounts for the color of the former, while the latter, judging from its taste, contained mainly alkalies. As a noticeable fact, we observed that these colors were not merely due to the effect of underlying rocks, but that the water was really so colored. Over rocks, through water, knee deep in yielding mud we scrambled along, until we finally stood at the edge of an oval basin surrounded by almost vertical walls, where the Boiling lake had been. Formerly it must have extended about three hundred by

two hundred and fifty yards, but at the time of our visit the disturbances about one and a-half miles distant had destroyed the lake, leaving only a boiling spring of about fifteen by twelve feet. Here the water issued with tremendous ebullition. It was unsafe to approach within a few feet of the spring after the descent to the former lake bottom had been made, and it thus became impossible to ascertain the exact temperature. The spring was located near the center of the lake bed, from where its water flowed off through a narrow opening in the enclosing walls. Every step was taken on hot ground, and a cane pressed down into the earth would be followed by the hissing sound of escaping steam upon withdrawal. Fortunately we found cold water, at the upper end of the lake, trickling down on the face of a rock, and we were spared the torture of

> "Water, water everywhere
> Nor any drop to drink."

From examinations made we found that the lake had not been *filled up* by masses of rock or soil projected into it, but that the confining dam had broken away and the water had flowed off. In view of the fact that seismic action appears to have been very subordinate at the time of the "eruption," it seems probable that the lake suddenly received accessions of water and thus forced its way downward, carrying with it the former barrier. At best the depth of water, unless perhaps immediately over the hot spring, which once formed an integral portion of the lake, must have been inconsiderable. Its elevation is about 2400 feet above sea level.

Had not personal inspection of the surroundings of the lake been convincing that the "eruption" did not take place there, the evidence afforded by mutilated plants would have been conclusive. No other word but "terrific" can express the conception of the mass and overwhelming force with which rocks and boulders were hurled into the forest. On the southerly side—towards the above-mentioned crater-like depression—the bare broken trunks and stumps of trees, rarely over fifteen feet high, were literally mashed, while comparatively untouched on the reverse. About one-sixth to one-tenth of the total diameter was worn away by repeated concussion, and trees of tough fiber, so much as remained of them, were absolutely torn to shreds. Nowhere did we find indications of heat which might have been sufficiently great to fuse any of the minerals contained in the

trachyte. The reduction of the latter in size was purely mechanical, largely due to attrition, although certainly the force producing it was owing to causes entirely different. We estimated the area thus razed, of timber, at about nine square miles, and the average thickness of deposited lithological material at eighteen inches. Allowing for the fact that the latter was not densely packed, this estimate furnishes a total amount of more than 27,000,000 tons which had been removed from their normal position by catastrophic action.

As to the causes which produced the "eruption," the evidence on hand is sufficient to arrive at some conclusions. First of all, the idea of *volcanic eruption* must be dismissed. No grounds for such assumption can be found, and the immediate vicinity of the scene of action exhibits no trace thereof. On the other hand, the decomposition of pyrite and associated minerals is here the evident source of heat. Water is plentifully supplied by precipitation as well as by superficial and subterranean drainage. If we can assume, and it seems reasonable that we should, that either the supply of heat-producing material had increased without adequate vents for accumulating pressure being in existence, or that the vents, at the time acting as safety valves, were by some means reduced in area of cross-section, then, necessarily, an explosion must follow as soon as the pressure of steam and gases is able to overcome superincumbent weight. Added to this we have learned that decided barometric disturbances were observed on Dominica at a time immediately preceding the catastrophy. In case a bare equilibrium were maintained, certain changes of atmospheric pressure alone might account for a sudden release of gases under pressure. Every indication speaks for the assumption that the phenomenon is to be regarded as an *explosion* and not as an eruption, so far as the latter pertains to vulcanicity.

In the course of a few years the damages so suddenly wrought will have been repaired again. Plant life in this climate is vigorous, and it will seem but a short time ere the now barren slopes will once more be clothed in green. Nothing will remain but some scarred veterans to tell the tale of the disastrous explosion of 1880. Although a repetition of such occurrences may be looked for, the area is too limited and the seat of disturbing chemical action too superficial to endanger the safety of Dominica.

THE SAND-HILL CRANE.

BY HON. J. D. CATON.

SOME observations which I have made of the habits of the sand-hill crane *(Grus americana)* in domestication in my acclimatation grounds, may be interesting, as I am not aware that this interesting bird has been much studied under such conditions.

Seven years ago Father Terry, the Catholic priest in Ottowa, Illinois, presented me with two sand-hill cranes, then three years old. They had run about his house and yards, and in the street of the city near by. They manifested a strong appreciation of the kindness he had shown to them, and whenever he returned home, whether in the day or the night time, they manifested their satisfaction by their loud calls and uncouth gestures. If in the street they were pursued by a dog, they took wing and flew home with the ease and facility of the wild bird, and yet they showed no disposition to leave and revert to the wild state, even at the migratory season of the species.

In my grounds they necessarily received less personal attention and gradually became less attached to man, but could often be induced to dance and play with me in their awkward but very amusing way. They are inclined to be imitative. Forty years ago, when they were very abundant in this country, a farmer whom I well knew, assured me that he had one in domestication which when a year old would fly on to the hay stack and tramp around in imitation of the boy, and would also take the lines in its beak and follow the horses, breaking prairie, for a considerable time, with a stately strut that was very amusing.

For the first year or two in my grounds they were inclined to associate together, but gradually become estranged and avoided each other's society. Indeed for years they avoided each other, and were never seen together. One season one of these birds got into the north park and attached itself to the pigs, which it followed about constantly, and when it returned to the south park seemed quite disconsolate, and kept near the dividing fence where it could see its friends on the other side, and if they came near would greet them with its loud harsh note, which could be heard half a mile away. Several times during the summer she managed to join her unnatural associates and followed them with

a constant devotion; this is the only instance in which I have seen one of these birds attach itself to any other animal in the grounds.

I have never observed these birds to eat grass. When they were abundant here in the wild state, they were considered very destructive to the winter wheat after it had sprung up and attained a considerable growth in the fall. I have seen hundreds together on a wheat field in November, but I was so careless an observer then that I cannot tell whether they took the blades of the plant or the decayed seed or roots. The only food I have observed them to take in my grounds was maize and insects.

There are two ponds of water in the grounds, in which there are small frogs, but I have never seen them step into the water or hang about them as if hunting for food. Others seem to have proved that in the wild state they habitually feast on frogs and small snakes, but if they do this in domestication it has escaped my observation.

When these birds were eight years old, that is two years ago last spring, both laid eggs—two each—both eggs were laid on the bare ground without the least attempt to make a nest, and neither attempted to set upon the eggs, though one of them stood about them for a few days as if to guard them, and made a great outcry if any one came near. The next year (1879) they again laid two eggs each, on the naked ground as before, without any nest. This time one sat upon her eggs with apparent devotion for three days, when, as if appreciating that it was labor lost, she left them without further attention.

Last summer, through the kindness of Dr. Row, of the Chicago *Field*, I obtained a male bird, one year old, as I understood, and placed him in the grounds with the others. He was not quite as large as the adult females. He manifested no disposition to associate with either of them. All three wandered about the grounds separately, though the females when they chanced to meet the youngster treated him as though they regarded him as an intruder.

In October last one of the females was killed by a mink who ate off the head and part of the neck, leaving the body untouched. (The same rascal no doubt killed a pair of Hawaiian geese which I valued above price.) I had it cooked, and though nine years old found it tender and of excellent flavor.

During the winter the remaining pair of cranes were forced into a closer companionship, as they remained about the premises where all the fowls were fed with Indian corn. Early in the spring they manifested their natural instinct by a closer intimacy, and soon became inseparable.

On my return home about the first of June I found the female setting on four eggs in a nest consisting of a slight depression on the border of a bunch of leaves which had been arrested by a pile of brush. The nest was not protected by the brush but quite outside of it. The keeper informed me that she had been thus faithfully employed for four weeks, and I hoped soon to see the young birds and determine the period of incubation. She sat upon that nest with great constancy for four weeks longer, when I ordered the eggs to be removed.

The habit of the cock during this time was quite interesting. He spent most of his time pretty near the nest, and guarded it with great fidelity and defended it with courage. If a cow or a deer came near it he flew at it in a rage, and a few thrusts with his sharp beak sent it away in a hurry, and if he saw a buggy coming in that direction, he raised his coarse harsh voice in so threatening a way as not to be mistaken, and if it came too near he flew at it, attacking either the buggy or the horse, whichever he happened to be nearest, and if it went within say fifteen or twenty feet of the nest, the female would leave the eggs and join in the attack, and the premises were soon cleared. Indeed, my friends who are in the habit of visiting my grounds soon learned to give that family domain a wide berth. In fact he was almost as constant in his watchfulness, and as pugnacious in his conduct as a wild (Canada) gander whose goose was sitting across the ravine.

It was the habit of this cock whenever the hen left the nest to seek for food, to take her place, and do the best he could, but he cut an awkward figure sitting on the nest, for his long legs seemed to be much in his way, while the female had managed to assume rather a graceful position while performing that maternal duty. The eggs probably were not in fact fertilized. I hope to be more fortunate next season, and raise a brood of young sand-hill cranes.

The male is now fully one-third larger than the female, though he is but two years old. Since the nest was broken up both are

constantly together, rarely being seen twenty feet apart. He is as gallant in the defence of his mate as ever. But the other day I picked up the female to examine more closely the red portion of the head when a vigorous thrust of his sharp beak as he flew at me admonished me that he thought I was taking unwarrantable liberties, and the attack was followed up with great vigor till I got the whip and tickled him smartly about the head, when he retreated in tolerable order. In the mean time the female had got quite a way off, which no doubt he thought a good excuse for the discontinuance of the attack.

A word about the color of these birds. One of the females when they came into my grounds had two white feathers on the back, which have proved constant ever since. All the others are of the regulation blue of the species. I think Audubon would have admitted that a ten year old bird was no longer young, and would have despaired of ever seeing it turn into a white *Grus canadensis.*

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ON THE MICROSCOPIC CRYSTALS CONTAINED IN PLANTS.

BY W. K. HIGLEY.

[*Concluded from October number.*]

I shall now take up the species of the family Vitaceæ and in these a wider view of crystals will be presented.

This family gives us a good field for the examination of both raphides and sphæraphides in the same plants. In all the species that I have examined the raphides were the most abundant in the leaves with their appendages, the petiole, and the epidermis of the stem in young plants, while the sphæraphides were more common in the old stems and berry, but were also found, though rarely, in the other parts mentioned for raphides. Crystals in the grape have been known for a long time. In the common cultivated grape, raphides are abundant, but the largest are only found in the leaf and petiole, and at times much smaller ones may be looked after in the fruit. These crystals, whenever found, gave the test for phosphoric acid and lime. In the pulp of the berry sphæraphides are abundant; those of the fruit stalks were about

$\frac{1}{1000}$th of an inch in diameter. When a collection of these is met with they form a beautiful field, which I think is only surpassed in beauty by the sphæraphid tissue in the testa of the elm. These crystals would not answer to any of the chemical tests except those for calcium, so that I have reason to believe that the base was combined with some organic acid, perhaps tartaric.

Vitis æstivalis and *V. cordifolia* abounded in both sorts of crystals, but neither were as large as in the common grape. In *Ampelopsis quinquefolia* I found raphides, but they were often free, that is they were not in a close bundle. The sphæraphid tissue is very fine in this species. Each crystal seems to form a nucleus to a single cell. The cells are placed very regularly and symmetrical in form. The blackberries contained raphides in more abundance and of a larger form than those of the grape fruits, but the largest were in the leaves and petioles of the younger shoots. The sphæraphides were not as large as those of the grape. As in the genus Vitis the crystals of this species, except those mentioned last, seemed to contain lime as a base and phosphoric acid.

In this family all the crystals contained in the fruit, except the raphides, gave the tests for lime, but failed to give the tests for the common acids, so that I think it probable that the base was in combination with some organic acid. I expected to find in this family more acicular crystals, but in this I was disappointed.

The next order that I shall report upon, as is well known, is the largest natural order, and is represented by a number of hundred species, it being universal. This family, the Compositæ, is well represented in the Northern States. Raphides are not as common in this family as in the other two, Araceæ and Vitaceæ, but forms of all three classes do occur. I have only found the needle-shaped crystals in the ovary or fruit, and sometimes in the receptacle and involucre. In some species minute cubical crystals occur which dissolve with effervescence in acetic acid. Globular masses of crystals known as inuline are quite common. I did not find the raphides in bundles except in one case, *Achillea millifolium*, which contained in the receptacle, on the average, about twenty raphides in each bundle; in all other cases when raphides were found they were single, which was perhaps due to some disturbance.

In *Inula helenium* I could find no crystals except the globular

aggregate known as inuline. This substance is an organic compound having the composition $C_6 H_{10} O_5$. Miller says that this is a variety of starch, insoluble in alcohol but soluble in hot water, and by boiling with dilute acids it is converted first into dextrine and then into pure lævulose. It forms an insoluble precipitate when its solution is mixed with one of acetate of lead and ammonia is added. I did not attempt to extract it from the root as that is quite a difficult operation to perform. The crystals appear like a globular mass with fissures radiating from the center outwards; iodine when applied to the well-cleaned section, gives with inuline a distinct yellow color. This statement is in direct opposition to that made by Fluckiger and Hanbury (see Pharmacographia under elecampane). The only part of the plant that I had was the root, it being too early for the stem, leaves, etc., so that I am not able to state what might be found in the other parts.

Taraxacum dens-leonis also contains inuline, but in much smaller amount than the last, and also a few sphæraphides, which seem to have no particular location, as they may be found, on close examination, in almost any part of the plant, although rare. They were too small and too few in number to obtain any definite chemical tests with them. Also raphides were present, but only in small numbers and not in bundles.

Cichorum intybus contains inuline but it is in still smaller amounts than in the last.

I also found inuline in the root of *Cirsum arvense*, or Canada thistle; in which plant raphides are formed in the flower receptacle and also in the parts of the flower, also some other crystals which seemed to have four faces tapering to a point at each end (crystal prisms). The number of faces were probably double this. These crystals were soluble, with effervescence in hydrochloric and not in acetic acid. The raphides gave the chemical test for phosphate.

In *Cirsium muticum*, or swamp thistle, the crystals of inuline were very small and indistinct. The raphides were found the same as in the last species, though more numerous. The crystal prisms I was not able to find at all, the reason perhaps is, that I had only a young plant, while of the Canada thistle I had a fall or late specimen. *Cirsium lanceolatum* gave the same results as *C. arvense*.

In *Cynthia virginica* raphides of small size but no inuline were found. There were also a few cubical crystals in the lower part of the stem and in the flower receptacle, which gave answer to the test for carbonic acid with acetic acid, but the raphides proved to be phosphate. The cubical crystals were about the $\frac{1}{2000}$th of an inch in diameter.

Senecio aureus and *S. balsamitæ*[1] contained acicular crystals which, upon chemical examination, gave evidence of oxalate of lime. In this genus I was not able to find any raphides at all, nor any inuline. A few crystals were present, but on account of their small size and number, I was neither able to determine their form nor chemical nature.

Lappa major, or common burdock, contained in the flower receptacle and dried fruit, minute cubical crystals, which gave the tests for carbonate of lime. No raphides or acicular crystals of any sort were present.

Tanacetum vulgare contained both cubical and acicular crystals, the latter in the leaves and petiole, and the former in the flower parts; and upper part of the stem; both oxalate and carbonate of lime seemed to be present.

The raphides of this order seem to be rarer in the division or sub-order Liguliforæ, while the acicular crystals or crystal prisms were only found in the sub-order Tubuliforæ. Inuline is common to both sub-orders.

It will be seen on reference to my work that the raphides seemed to be composed of phosphate of lime, the acicular or crystal prisms, of oxalate, and the cubical crystals, of carbonate of the same, while the sphæraphides seemed to be the same base combined with different acids according to their locality.

It will be remembered that in the first part of this paper I mentioned the fact that crystals of some form were nearly if not quite universal, and as some slight evidence of this I have compiled with care a list of all the families in which crystals have been reported. This is the beginning of a more complete list of the genera and species which I hope soon to have ready for publication, which will be classified according to the kind of crystals that the species may contain.

[1] A variety of *S. aureus*.

The following is the list of families :

CRYPTOGAMIA.

[1] Filices	Musci
Equisetaceæ	Algæ
Hepaticæ	*Fungi.*
Characeæ	

PHÆNOGAMIA.

EXOGENÆ.

Araliaceæ	Halorageæ
Aurantiaceæ	Juglandaceæ
Balsaminaceæ	Leguminoseæ
Berberidaceæ	Linaceæ
Cactaceæ	Melastomaceæ
Camelliaceæ	Nyctaginaceæ
Caprifoliaceæ	*Oleaceæ*
Caryophyllaceæ	*Onagraceæ*
Chenopodiaceæ	Orobanchaceæ
Cinchonaceæ	Oxalidaceæ
Compositæ	Passifloraceæ
Coniferæ	Phytolaccaceæ
Crassulaceæ	Polygonaceæ
Cruciferæ	Pittosporaceæ
Cycadaceæ	*Rubiaceæ*
Droseraceæ	Saxifragaceæ
Elæagnaceæ	Scrophulariaceæ (Gelsemineæ)
Euphorbiaceæ	Tetragonieæ
Ficoideæ	Tiliaceæ
Fumariaceæ	Urticaceæ
Galacineæ	Valerianaceæ
Geraniaceæ	*Vitaceæ*
Galiaceæ	Zygophyllaceæ.

ENDOGENÆ.

Amaryllidaceæ	*Linaceæ*
Araceæ	Marantaceæ
Bromeliaceæ	Melanthaceæ
Burmanniaceæ	Musaceæ
Butomaceæ	*Orchidaceæ*
Cyperaceæ	Orontiaceæ
Dioscoreaceæ	Pandanaceæ
[2] *Gramineæ*	Pontederiaceæ
Hæmodoraceæ	Smilacaceæ
Hypoxidaceæ	Typhaceæ
Iridaceæ	Xyridaceæ
Juncaceæ	Zingiberaceæ.
Liliaceæ	

[1] In this family I have seen crystals but once, and these were contained in *Phegopteris hexagonoptera*.

[2] The crystals of this family were shown to me by a fellow student in the University, Ann Arbor, Mich.

The names that are in italics indicate the families in which I have seen and studied the crystals, but only in a few cases their chemical composition.

Some of these, as the Onagraceæ and Orchidaceæ, contain large and beautiful crystals. In the vanilla bean, which is a fruit belonging to a species of the latter family, T. F. Meyer, of the university class of '78, has reported and made drawings of the crystals. He states that they are composed of the active principle of the bean and belong to the second class or crystal prisms.

It is often supposed that minute substances have no particular use, and so it may be thought of these minute crystalline bodies; but generally anything that occurs in such abundance and so regularly has some use in the economy of either the animal or vegetable kingdom. On the use of the crystals Prof. Gulliver says: "Although the precise use of crystals in the vegetable economy may be obscure, it is plain that whatever is constant in the plant must be important, and by no means necessarily of little importance because of such obscurity." Taking, for example, the Cactus family, which abounds in large crystals, some specimens of which have been reported to contain so many of these minute inorganic bodies that it was almost impossible to move the plant without breaking it, and when moved it was necessary to pack it in cotton with great care, as if it were the finest jewelry. A case like this is seldom met with, but as the occurrence of crystals is so constant a feature of this family, they must be of some use, which is, as yet, beyond the reach of man's power to perceive, and it would seem ridiculous to say that they have no use as some prominent scientific gentlemen claim.

But such crystals may be of use to man, perhaps in two ways; first, when contained in some medicine.

It is well known that the disease called "rickets" is treated, or at least has been, with sarsaparilla; now the plant itself contains a large number of crystals which are composed of phosphate of lime. Query—why may not this plant, in connection with its tonic effects, also furnish some of the needed phosphate to strengthen the bones?

Second, they may be of use to man when contained in decaying leaves or plants, thus acting as a fertilizer.

Again, crystals are sometimes used by the merchant as a test for the genuineness of a drug. The quality of rhubarb is often

tested by its grittiness, which is due to inorganic crystals, and rhubarb should contain a high per cent. of inorganic matter.

Other uses might be enumerated and given in this list, and perhaps some of them are of more importance than those mentioned, but sufficient has been said to show that they are probably of some practical value to man. It is hoped that this article will induce other investigators to take up this subject and find, if possible, their exact use in the economy of the plant.

The time is probably not far distant when we will know more about microscopical crystals in plants, and for that time we must all wait, each investigator endeavoring to do his best.

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ON THE ORIGIN OF THE LAC.[1]

BY J. M. STILLMAN.

DURING the course of an examination of a product from Arizona, apparently identical with the gum-lac from India, I had occasion to consult various works touching on the origin of this interesting product.

The statements met with were in many cases contradictory, and the most usual statement so directly opposed to what appears to me, from a careful examination of the deposit and of the evidence on the subject, to be the truth, that I cannot refrain from at least suggesting what seems to me to be the true state of affairs. At the same time I wish to state, that as far as the lac insect is concerned, I have not been able to find sufficient data regarding its anatomy and life-history to enable me to touch upon some very interesting points in connection with the subject. Nor am I cer-

[1] This paper was read before the California Academy of Sciences, April 19, 1880.

tain that the questions here considered have not been thoroughly discussed by previous investigators, but if so, the current chemical literature, encyclopædias and some of the natural history treatises have overlooked such work, so that there has crept into the literature a statement with regard to the origin of the gum-lac which I think is an incorrect one. This is, that the gum-lac is an *exudation* caused by the puncture of the lac insect (*Coccus lacca*).

This is stated in such standard works as "Muspratt's Chemistry" (even in the late German edition), Wurtz's "Dictionnaire de Chimie," "Johnson's Encyclopædia," &c., and in various text-books on chemistry, and various works on natural history accessible to me. "Chamber's Encyclopædia also asserts the same fact by saying that the insects "entomb themselves in a mass of matter which oozes from small punctures made in the twigs of the tree," but also adds, "As we have no strictly analogous resin from the vegetable kingdom, *not even from* the lac-bearing trees, it may be assumed that the *juices of the trees* are somewhat altered by the insects."

Watt's "Dictionary of Chemistry," on the other hand, says: "Lac is the product of the *Coccus lacca*, which deposits its eggs on the branches of a tree called Bihar in Assam and other parts of India. It appears designed to answer the purpose of defending the eggs from injury and affording food for the maggots in a more advanced state. It is formed into cells finished with as much art and regularity as in the honey-comb, but differently arranged."

This statement is not to be accepted entirely, I think, but in so far as it states that the lac is the product of the insect rather than of the tree, I think it is correct, and it is this thesis that I wish here to maintain.

Let me first state briefly all that I feel confident of regarding the life-history of the *Coccus lacca* of India. The lac insect, like many other insects of its kind, lives and dies in the same spot. The young insect, after emerging from its hatching place in the body of the mother, crawls off as an extremely minute bug of a bright red color. It very soon attaches itself to the branch, loses its legs, antennæ, &c., its sides expand and it becomes fixed to the branch like a minute scale bug. Here it grows and lives upon the juices of the twig which it sucks from minute punctures in

the bark. If it be a female, and I shall take cognizance here only of the female insect, as it grows older it forms its eggs, and the entire insect develops into a shapeless sac enveloping these eggs. Within this sac is developed at the same time a purple-red gelatinous mass which contains the eggs and perhaps serves as food for the young insects. By this time, also, the numerous sacs are entirely enveloped in a heavy mass of the lac-resin. The cellular structure of the latter is caused by the soft sacs of the females enclosed in the hard resin. When the young are hatched, they bore a hole through the back of the mother-sac and through the resinous envelope and escape, fix themselves to new portions of the plant and the life-history begins again.

Now, although I am by no means confident that the Coccus which forms our Arizona lac is identical with the *Coccus lacca*, yet I think that I can show that the resemblance is sufficiently close to enable a course of reasoning on this insect to apply to the Indian species as well. In the first place the very great chemical similarity of the Arizona gum to the Indian, as shown at a meeting of the California Academy, is a presumption to this effect. In the next place, the coarse cellular structure of the resin, the enclosed sacs with the eggs and purple juice, formed in the Arizona product and agreeing with the descriptions of the India lac, are another set of facts strongly confirmatory. Lastly, the specimens of lac from Arizona with the holes bored in it by the escaping insects, furnish additional evidence of close agreement. Very recently also I have received from Mr. J. A. Culbertson, of Arizona, specimens of the young insects affixed to the twigs. They are minute scale-bugs of a red color, with indistinct markings across the back. In size I should roughly estimate them at one-fiftieth of an inch in length and half that in width, though some are even smaller. No doubt could exist but that they belong to the Coccidæ, and that they are very similar in development and life-history to the *Coccus lacca*. Hence I think that any general deductions from examination of the Arizona lac will apply equally well to the India product, especially as all descriptions of the products of the insect—lac-dye and lac-resin—seem to coincide.

We notice first that resin is developed only by the action of this insect. No similar product can be obtained from the plant by other means. This is stated of the India lac in the sentence

above quoted from "Chambers' Encyclopædia." Eye-witnesses say, that the Arizona lac also does not occur wherever the plant, upon which it grows, is found, but only in particular regions or patches. In the second place the gum-lac of India occurs on no less than five trees, *Ficus religiosa*, *Ficus indica*, *Rhamnus jujuba*, *Croton lacciferum*, *Butea frondosa*, and that from Arizona on two plants, the *Larrea mexicana* and *Acacia greggi*. These plants are not related for the most part, and do not afford the gum except under the influence of the insect.

In explanation of these facts we have two alternatives to choose from. First, the gum is an exudation from the twig, excited by the puncture of the Coccus; it flows out, envelops the insects, hardens and forms the gum-lacs; or, second, *that the gum is the elaboration of the insect itself.*

The first explanation is the one usually given, the second one appears to me the true one, and the following facts and considerations appear to me to sustain this view:

1. The gum-lac is not simple, like most vegetable resins, but is composed of resins soluble in alcohol, wax and gluten, or substances resembling gluten. Such a complex substance might be expected from an animal secretion.

2. The resin, as far as known, possesses the same general composition and properties independent of the species of plant, whence it is derived, since no specific difference is given for any of the seven India varieties, and the two Arizona sorts have probably the same general composition. The kind of plant and the character of its juices undoubtedly have a general influence, inasmuch as the sap of some plants would not support the life of the insect nor furnish it its necessary materials for the elaboration of its products.

3. If the resin were an exudation from the plant, simply induced by the puncture, we should expect to find this resin more or less collected into globules, drops, or masses independent of the immediate presence of the insect. In my examination I could find no particle of resin which did not form a bounding wall to one or more of these cells occupied by the egg-sacs.

The only places, where the resin appeared solid and thick, was in the spaces between three or more contiguous cells, as if the sacs had, by their united secretions, filled up the small room between them. In some specimens what appeared to be a small

drop of resin on the bark, where a small insect had covered its dome-shaped body with a layer of resin, was as thin-walled as the shell of a mustard seed. In such a case we are called upon to suppose that a flow of resinous juices starts from below the insect, passes up over its body and nowhere else, and covers it with an even layer of resin. This is to me a difficult conception.

On the other hand, it is easy to conceive how the insect simply feeding on the juices from below, and secreting this resinous substance from its body, could build such a shell of resin.

4. By careful examination of bark and wood, no puncture or abrasion could be detected at all adequate to account for such a *spontaneous flow* of the sap of the plant, as would produce the amount of resin present. This examination was repeated with the assistance of Prof. Joseph Le Conte, who concurred fully in the conclusion arrived at.

All these facts, so inexplicable on the exudation theory, appear to me to be readily explained on the basis of the insect origin of the gum. The insect fixes itself to a spot on the bark where it lives and dies. For its sustenance it is dependent on the sap of the plant. Certain plants are adapted to this purpose, others are not. The juices sucked up and absorbed by the insect serve as its food, and at the same time as material, from which is elaborated the resinous envelope, destined to serve as a protection for the eggs and larvæ. This resinous substance may be exuded from the entire surface of the insect, or from particular organs or glands; I am in no position to pursue this point, interesting as it is. This elaboration thickens as the insect grows older, and as the insects live in close proximity they become crowded and distorted, and the spaces between them compactly filled with their united elaborations, so that the result is as we see it, a resinous mass of coarse, irregular, cellular structure, with the egg-sac filling the cell, or, after the specimen is dried or the young escaped, with the shrunken remains of sac and eggs in the cell.

This explains the occurrence of practically the same resin on various plants—the form and structure of the resin—that it surrounds the sacs on all sides perfectly, but does not run off along the bark of the twig nor collect into solid drops or masses—a fact difficult to explain on the simple exudation theory. It also gives a definite meaning to the "alteration" of the juice by the insect referred to in "Chambers' Encyclopædia."

Whether the lac is to be considered as an excretion or secretion is very much a matter of definition. If by secretion we mean a definite substance elaborated by the organism for a definite purpose, this would appear to be a true secretion. On the other hand, once secreted it probably exerts no further internal function in the organism, and is in so far an excretion. In the same sense, hair, nails, epidermis, etc., continually discarded by the organism, might be considered excretions. However we may regard it, it is probably a normal product of the vital activity of the lac insect.

A somewhat striking objection against this theory is, that it is against analogy, that a well-marked resin should be the product of animal life. But so also is the production of *wax* by the bee against the same analogy, and yet it has been proven that bees confined to an exclusive diet of sugar will produce wax formed by their own vital processes, and any philosophical distinction between *wax* and *resin* in *this* particular would, I think, be difficult to establish.

In conclusion, I would again reiterate that I am by no means certain that the question of the origin of the lac has not been settled by observers more directly interested in natural history, but if so, our chemists and encyclopædists have been slow to find out the facts, and our most recent authorities, with few exceptions, adhere to the exudation theory. If this communication has the effect of bringing to notice previous work, or gives rise to more complete investigations in the future, it will be as much as I can expect from it.

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BOTANIZING ON THE COLORADO DESERT.

BY EDWARD LEE GREENE.

I.

IN February of 1877, by way of the stage road between San Diego and Fort Yuma, I made a little expedition across the interesting region above named. A desert is not naturally supposed to be the most eligible locality, nor midwinter the best season for making botanical excursions, yet seldom has a week's recreation of that kind given me more satisfaction than that upon which I have preserved the following notes:

In passing from west to east across Southern California, the

first glimpse one gets of the desert is a fine bird's-eye view. From the San Diego plains, all treeless, brown and dusty, an easy two days' journey brings the traveler up to the level of that broad plateau which constitutes the summit of the coast range. Across this forty-five miles of mountain top, one travels pleasantly; now through handsome groves of evergreen oaks, then among a succession of low, rounded, stony hills, between which some bits of fresh, green mountain pasture spread themselves; here passing a settler's cabin with its newly ploughed fields and its group of blooming peach trees, and there meeting a merry, boisterous gang of mountain herdsmen. Having thus come to the eastern verge of the plateau, the great wilderness breaks all at once upon the view, beginning a dizzy half mile down beneath your feet, and stretching away to the eastward for a hundred miles. It was past the middle of the afternoon when I reached this interesting point, and paused to rest a while and to enjoy the novel scene, so desolately grand, which lay before me. The region in question is far from being a flat monotonous expanse of naked sands.

Its general level is broken by many abruptly rising knobs and peaks and by several prolonged chains of high and sharply defined rocky hills, all lifting themselves up like precipitous islands above the even surface of a sea; and although these peaks and ranges are destitute of verdure, and red as the sands that drift about their bases, they yet combine to make a most impressive picture when viewed at a distance, and from this aerial elevation where the desert first appears in sight. Aware that the stage station where I must pass the night was not more than two miles away by the steep, winding road, I lingered here until the sun was near his setting, and the shadows of the peaks and pyramids I sat among, were measuring their dark lengths upon the plain afar below, and the purple evening clouds had reflected their own almost gorgeous coloring to the vast, varied landscape that stretched eastward and northward so very far away. This strange sunset scene was beautiful beyond all description, and will be treasured for a lifetime in the beholder's memory.

Having descended from these picturesque heights, it was nearly dark when, as the road led around a sharp angle of the mountain, I found myself almost at the door of the stage company's little hotel. Here were pleasant sounds; the music of water trickling

down through an iron pipe from a small spring that rises among rocks which almost overhang the house hundreds of feet above; and by the way, the sound of running water is never so musical as when one has traveled six hours in torrid heat without having tasted a drop. Music also of insects was here, evidently some sort of bees which, even in the late twilight, were humming amid the rosy, flower-laden boughs of the desert almond. This handsome bush (*Prunus andersonii* Gray). when in flower, resembling a small peach tree, contrasts very prettily with its associates, the cacti and agaves which thrust forth their clumsy, graceless forms from every niche and crevice of this grand mass of rock which walls in the desert on the west. While most trees and bushes of that genus require good soil and a fair supply of moisture, this species appears to thrive, like the spiny cacti, on nothing more substantial than the sunburnt rocks and the desert air.

The condition in which I found the solitary tenant of this isolated hostelry illustrates one of many dangers to which the lone keepers of these desert stations are exposed. He was bending over a basin of water bathing his head and face, which parts, as I could see by what remained of daylight, were bleeding freely. He seemed in too much pain to notice the near approach of the stranger, at whose unexpected presence the man's sole household companion, a fierce bull-dog, tugged away at the end of the chain in a rage which I should not have smiled at had the chain been a light one. Presently, however, the man tied a bandage about his head, unbent himself, turned toward the door where I was standing, and I inquired what had befallen him. He replied that he had, a few moments previous to my coming, gathered himself up from the stable floor where he had been lying unconscious he hardly knew how long, having been kicked by a vicious stage horse left in his keeping. Luckily for him and somewhat so for me, tired and hungry as I was, the wound was not serious. He was an intelligent youth, intelligent enough to comprehend my reason for undertaking a walk across the desert. Under his cabin roof I fared well, and on the hardest of beds enjoyed such sound, refreshing sleep as is given to tired but happy travelers.

From this hostelry among the cliffs, a few minutes' morning walk brought me to where the mountain flanks are parted by a deep gorge indicating where, in times long past, a river made its way from the highlands down to the sea which then occupied the

area now a desert. The road here descends to the dry bed of the extinct river, and follows it directly to the plain. The grade is easy but the loose white sand is deep, and in this sandy rock-walled passage I met two Indians, a man and woman, whose decrepid forms, withered features and whitened hair made them look almost prehistoric, toiling upward on foot, each with a heavy pack of blankets and pottery on their backs, while a few rods behind them a stalwart youth of about thirty years rode in serenest laziness a half-starved looking pony. It was probably another party of herborizers this, on their way up to the rocky heights where the wild maguey plants grow, to feast on the tenderly springing flower-stalks, and make mezcal.

February days in this region are nearly as warm as days of July in New England, and as I walked along the south wall of the cañon, gratefully sheltered from the heat of the morning sun, I easily comprehended the origin of that oriental phrase: "The shadow of a great rock in a weary land." Here at my feet, where the sand was shaded, grew and bloomed a low spreading variety of evening primrose (Œnothera), with large, pale yellow flowers. On the opposite side, more exposed to the sun, the whole base line of the rising cliffs was ornamented with a continuous hedge-row of a very handsome shrub (*Hyptis albida* H. B. K.) with whitish foliage, its branchlets ending in slender spikes of fine, deep purple flowers. The desert shrubs, however brilliant their flowers may be, are usually without much show of foliage, most of them bearing spines or briers instead of leaves.

But besides this pretty, white-leaved Hyptis, I noticed one other exception to that rule in the case of a smaller bush (*Beloperone californica* Gray), the stems of which were buried half their length in the drifting sands, and whose salvia-like spikes of scarlet flowers were subtended by neat foliage of a bright shining green. From admiring these first beauties of the desert, my attention was next drawn to a tuft of tall, slender, reed-like stems with pale-green bark which, though appearing wholly leafless, produced at their summits several pendant clusters of white flowers. At a few rods distance one would never have guessed this graceful plant to be a near relative of the stout coarse leaved silk-weed of Eastern fields and waysides; but a glance at the structure of the flower showed the plant to be a genuine Asclepias (*A. subulata* Dec.). The stems, though altogether smooth

and reed-like as seen at a distance, show distinctly, to the nearer view, the nodes at which, in other species of the genus, broad, flaunting leaves are developed, and at each of these leaf-nodes the careful observer detects a pair of minute, awl-shaped appendages which are technically the leaves of this anomalous Asclepiad of the desert.

On passing forth from the mountain gorge to the open plain, the eye is greeted by an assemblage of such strange-looking vegetable forms as command the wondering attention of all travelers, whether scientists or not. Among these the cacti are the most conspicuous; some of them globose or cylindrical, resembling so many enormous melons set up on end, having prickly sides and bearing flowers and fruits at the top. Others are more like orchard trees, with smoothish trunks and well-rounded heads of branches bending under a load of pear-shaped fruits.

One of these cacti (*Opuntia bigelowii* Engelm.) is, in its general aspect, doubtless a more forbidding thing than any "thorn" or "thistle" which the ancestral fugitives from Eden ever met with in oriental wilds. If the reader wishes to form a definite and tolerably correct idea of this plant's appearance, let him imagine a post four or five feet high and as many inches thick, putting forth, from its upper extremity, a half dozen clumsy arms or branches of the size and shape of ordinary ball-clubs, the trunk and club-shaped branches all so thickly beset with long, needle-like, glistening spines, that the spines are actually the only part of the plant visible. With such a horrid growth as this the grand knolls and lower slopes of all the hills are covered.

Extremely odd looking and not more odd than beautiful is the small tree locally known by its Mexican name ocotilla (*Fouquiera splendens* Engelm.). It grows to the height of from eight to twelve feet, and in outline is quite precisely fan-shaped. To show how this may be, let me describe more particularly its mode of growth. The proper trunk, usually ten or twelve inches in diameter, is not more than a foot and a-half high. At just a few inches above the surface of the sands this trunk abruptly separates into a dozen or more distinct and almost branchless stems. These simple stems rising to the height of eight or ten feet, gradually diverge from one another, giving to the whole shrub the outline of a spread fan. Each separate stem is clothed throughout with short gray thorns and small dark-green leaves,

and terminates in a spike a foot long of bright-scarlet, trumpet-shaped flowers. This splendid oddity flourishes in great abundance in many places.

The stems are not so thickly armed with thorns but that a man may handle them if he will seize them circumspectly with his fingers, and being very hard and durable, as well as of a convenient size, they are much employed for fencing purposes about the stage stations and upon the ranches adjoining the desert. Give a skillful Mexican ocotilla poles and plenty of raw hide thongs, and he requires neither nail nor hammer to construct a line of fence which for combined strength, neatness and durability fairly rivals the best work of that kind done in our land of saw mills and nail factories. As a tree or shrub of strange peculiar beauty, the cultivators will vainly desire to add this to their list of varieties, unless their art can reproduce the parched and sterile gravel heaps and the dry, withering atmosphere which it finds congenial. Those who have ever experienced anything of a naturalist's enthusiasm will readily believe that the writer, in passing amid these and other unmentioned objects of thrilling interest, hardly felt the intensity of the mid-day heat, nor realized how much he was suffering from thirst until, at two o'clock, almost before he had thought of such a place or wished it near, he found himself but a few rods away from the station of Coyote Wells. This is the westernmost stopping place on the desert, only twelve miles out from the base of the mountains. The place derives its name from the fact that here the Coyotes, long before ever white men had passed this way, smelled water near the surface, and pawed in the sands until they reached it. These wells of the Coyotes having been suitably excavated and curbed up, supply the best water that has been found on all the breadth of the desert; the other wells being more or less strongly impregnated with offensive salts or alkalies. Having reached the shade of an adobe wall, I gladly took refuge from the heat, and for something less than an hour, did little but drink water. Dinner was then announced, after which I sought again the shade outside, rested, and studied for another hour the rugged outline of a mountain range which broke the level of the plain some ten miles to the northward. The station keeper was going to remove thither some day to settle and dig gold; plenty of the precious metal there; no doubt about it. Only a few years ago a white man and a negro had gone there to dwell to-

gether and amass each his fortune. A late party of prospectors passing that way had found the white man's bones whitening among the sun-burnt rocks. The conclusion was that the negro had murdered his partner and absconded with the accumulated gains of both. And with many such cheerful and edifying bits of history do they seek to beguile the time which weary travelers spend at these desolate halting places in the wilderness.

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EDITORS' TABLE.

EDITORS: A. S. PACKARD, JR., AND E. D. COPE.

—— Whenever an institution accepts a bequest designed to assist impecunious but worthy students in the acquisition of some useful kind of knowledge, such as natural history, its obligations to itself, the donor and beneficiaries of the gift, are plainly that it must, under the direction of a competent committee, see that the donated funds are applied to the objects for which they were given. Such bequests render the institutions accepting them, *charitable*, and if in addition the bequest is for the purpose of enabling any particular class of persons to acquire a specific kind of knowledge, the institution becomes *educational* in the same sense that any special school is considered to be such. Under no ordinary circumstances can the governing body in charge of such a trust, neglect the duty of ascertaining whether the persons directly in charge of the incumbent beneficiaries, do their duty, and whether the beneficiaries themselves are competent persons who are making the proper progress under the proper discipline. Otherwise there is room for maladministration under unauthorized authority; or, the beneficiaries with no direction, under no discipline or instruction, fritter away their time in fruitless effort, at a period of life when they can ill afford to lose it.

The Academy of Natural Sciences, of Philadelphia, some years ago accepted a trust of this kind. Mr. A. E. Jessup's children, out of dutiful regard for their father's wishes, gave the society a sum in trust, the income of which was designed for the benefit of impecunious young men who desired to devote the whole of their time and energies to the pursuit of natural science. The desire to give a sum of money for such a purpose in a man like Mr. Jessup was a natural one, which probably took its rise in the recollection

of his own early struggles for knowledge, when he, too, was poor. He wished that the money he had verbally bequeathed should be used for the support of *poor* young men only, who would devote the *whole* of their time to study. Have Mr. Jessup's wishes been fully complied with in the administration of the benefits of the fund?

It has been argued that inasmuch as the Academy afforded the facilities for study in its library and collections, that all Jessup beneficiaries should in return spend a certain number of hours each day at work for the Academy. This is now the rule. But, as it has been claimed time and time again that the Academy is a charitable institution, it does not seem to be in keeping with this claim to ask Jessup scholars to devote a part of their time to labor in order to pay the Academy for the privilege of studying in its building, especially when the work they are frequently expected to perform has no interest to them or no scientific bearing whatever. The character of some of the work at which Jessup scholars have been employed, may be gathered from the following statements of facts: In one case a beneficiary was put to washing shells to prepare them for a specialist; another was employed at brushing and dusting off the collection of stuffed birds; on another occasion one of them was set to work by the librarian to copy the titles of books in the library for compilation of catalogues, properly the duty of the librarian himself, for which he is employed and paid. It has become the rule to make the Jessup scholars take the place of the janitors at the door once or twice a week, to sell the tickets which admit strangers to the museum of the Academy. It is hard to make a mental distinction in these cases between the supposed duties of a janitor and a Jessup scholar of the Academy. For months at a time Jessup scholars were employed in packing, hoisting, moving and unpacking cases, specimens, books and lumber during the time when the library and museum were being removed to the new building, in company with other laborers, yet it was considered that this was a part of the curriculum of study for which they could properly receive pay from the Jessup fund. The president of the Academy has had his official correspondence copied in duplicate by a Jessup scholar on various occasions. Besides these abuses, the recording secretary was in the habit of having his weekly reports of the meetings of the Academy copied in duplicate by one of them for the daily press, and the corresponding secretary has the blanks acknowledging donations filled up by one of these scholars. They are also frequently used as messengers by the secretary, president and curators. They have become, in short, a species of men-of-all-work, useful to everybody about the institution, with no definite knowledge of their relation to the fund from whence they derive an income just sufficient, with close economy, to support themselves. These persons then are virtually employés of

the Academy, paid from the income of a bequest designed to foster free scholarships. Suppose the various scholarships in America and the fellowships in English universities were tenable only upon condition that a certain amount of manual labor was performed; would it be at all likely that Prof. Clerk-Maxwells or Sir Wm. Thomsons would be the results of the system?

A matter which also deserves notice is the custom of assigning to Jessup students the work of arranging and labeling the collections of which they possess no previous knowledge. This plan is in principle beneficial to the student, and its originators rightly comprehended the benefits to be derived from a systematic study of any given group of animals. But it is obviously improper to entrust the determination of a collection for scientific study to inexperienced persons, who are, moreover, sometimes careless, or quite indifferent about the accuracy of determinations. This plan is also objectionable on account of the fact that the training of a young naturalist in this way restricts him to a comparatively small group, so that he is quite unfitted to begin work as a teacher from a lack of comprehensiveness and the originality consequent upon a system of more general work. A broader preliminary training should be required of a person who applies for the benefits of this fund, all of which would redound to the credit of both the individual scholars and the Academy in after years. His knowledge of the elements of biological science should be as full as possible, so that he would not be afterwards compelled to go back and begin at the ground principles of his science, in order to underpin, as it were, his own mental superstructure.

In order to realize the abolition of what is manifestly wrong, as indicated in the foregoing recital, it is much to be desired that a living interest should be taken in the welfare of the Jessup scholars and scholarships, by members of the Academy, who by reason of their scientific attainments and experience as educators are abundantly able to do so. The apathy which allows the present condition to continue, is wrong, because the opportunities for the nurture of young men, who may become eminent naturalists, in the Academy might be made as good as anywhere in the United States. It remains the duty of the governing body of the Academy to appoint some naturalist who shall see that some sort of plan of study is followed by each student, and define and plan some specific courses of preliminary training in biology which would qualify the student to begin independent and original studies for himself, in which he might distinguish himself and reflect credit upon the institution which fostered him. The realization of some such method of training could readily be effected by the adoption of the scheme of professorships or curatorships which has elicited such an amount of silly animosity.

RECENT LITERATURE.

Bessey's Botany.[1]—To one who is desirous of obtaining a knowledge of general botany we should unhesitatingly recommend this manual. Most of the botanies which the student deals with are manuals of the flowering plants, rather than of plants in general, and thus he is led to believe that there are few plants in the world besides the flowering ones, that what do exist are of little importance, and thus his idea of the plant world is a limited and one-sided one; and by plant we mean not a phanerogam or cryptogram, but a plant as distinguished from an animal. In the same way many of our manuals of zoölogy are treatises on the vertebrated animals rather than on animals in general. It is true that in order to teach the elements of botany to beginners it is better to give them a general idea of the structure, physiology and mode of development of a common, well-known and accessible flower or tree; but if the study of botany is to be made a discipline, if the student is required to acquire a good general knowledge of the plant world—and our college students should be required to attain such knowledge—he must, after acquiring a good general knowledge of a few common flowers, master the kind and extent of knowledge contained in a book like the one before us. In short, he should study with the aid of some such book as this the types of the leading divisions of plants, beginning with the Protophytes and ending with the algæ, mosses, ferns and flowering plants, or at least, if the pupil is not carried so far in his studies, the teacher should be armed at all points in his knowledge of general botany, so that he may rightly inform the pupil regarding the structure and physiology of the lower plants, for the sake of bringing out more clearly the position in nature and general relations to other organized beings of the flowering plants.

While, therefore, this book is designed apparently for advanced classes, it will be of especial value to the thousands of teachers of botany in the higher schools scattered over the country. Without disparaging school books written by other botanists, it seems to us that Prof. Bessey's book is indispensable to the teacher of botany as it is or should be taught in these days in our leading colleges and universities.

It moreover derives its value in large part from being compiled from the works of Sachs, De Bary, Hofmeister, Strasburger, Nägeli, Schwendener and others; the first part following quite closely Sachs' botany, many of the admirable cuts in that book being reproduced, so that those who cannot obtain the more costly and voluminous work of Sachs can master this book.

The volume is divided into two parts; the first consists of

[1] *Botany for High Schools and Colleges.* By Charles E. Bessey. American Science Series. New York, Henry Holt & Co., 1880. 8vo, pp. 611. $2.50.

twelve chapters on the following subjects: protoplasm, the plant cell, the cell wall, the formation of new cells, the products of the cell, the tissues, the tissue systems, intercellular spaces and secretion reservoirs, the plant body, the chemical constituents of plants, the chemical processes in the plant, and twelfth and lastly, the relations of plants to external agents. We have read most of this part with much interest, and do not know of a briefer, clearer and better illustrated exposition of the subjects treated. It is well adapted to give one who has but little special knowledge of botany a clear conception of the plant as an organism. A good many technical names are used, and an elementary knowledge of botany is required of the student, so that while we doubt whether high school classes are sufficiently advanced to use the book, the teachers of such classes should master this portion and present it in as simple language as possible to their pupils.

The second part occupies the last four hundred pages of the book, and is entitled, Special Anatomy and Physiology. It treats of the general classification of plants. The arrangement of the lower plants is a modification of the system of Sachs, while the author has made a considerable innovation in raising the Protophyta, Zygosporeæ, Oösporeæ and Carposporeæ to the dignity of primary divisions of the vegetable kingdoms, of the same rank as the Bryophyta, Pteridophyta and Phanerogamia. This part contains brief general descriptions of the cohorts, orders and tribes of plants, with sufficient reference to economic botany.

The illustrations are excellent and abundant, there being five hundred and seventy-three cuts scattered through the volume, a large number taken from Sachs' Botany, from De Bary, Hofmeister and other German, French and English works, while a number are original, having been drawn by Mr. J. C. Arthur.

The work bears evidence of care and accuracy in its preparation, and while we have borne testimony to the general plan and its treatment, we leave to others the task of detecting and noticing the errors and shortcomings, if such occur.

HUXLEY'S INTRODUCTORY TO SCIENCE PRIMERS.[1]—Every incipient biologist or geologist should study this little primer, which will serve admirably its purpose as a brief and plain introduction to the study of nature. It is well calculated to be used as a text book for classes in elementary biology or geology, and we intend to use it as a basis for preliminary instruction to a course of physical geography. Beginning with nature and science it treats of sensation and things, causes and effects, the order of nature, laws of nature, and gives a definition of science. A second part discusses material objects, which are divided (A) into mineral bodies,

[1] *Science Primers.* Edited by Profs. HUXLEY, ROSCOE and BALFOUR STEWART. Introductory. By Prof. HUXLEY, F.R.S. New York, D. Appleton & Co., 1880. 18mo, pp. 94. 35 cents.

water being the mineral chiefly referred to for the sake of illustration, and (B) living bodies. Under the latter head the wheat plant and the substances of which it is composed, the common fowl and the substances of which it is composed, are described in the compass of three pages; then the constituents of the body common to the wheat plant and the fowl. What is meant by the word living, and how the living plant comports itself, and how the living animal grows, and how living bodies differ from mineral bodies is told in a few clear, simple sentences. Finally the science of biology and its subdivisions, botany and zoölogy, are defined, and a final page or two is devoted to mental phenomena and the definition of psychology.

EMERTON'S SEASIDE COLLECTING.[1] — In England and France popular works on the animals of the seashore, and the names of Gosse, Forbes, Kingsley and Quatrefages are associated with some of the most entertaining books that have ever been written. America, on the other hand, has been wofully deficient in works of this character. The only ones which approach it being Mrs. Agassiz's Seaside Studies, Verrill and Smith's Invertebrata of Vineyard sound, and the charming little work of "Actæa." In the present volume Mr. Emerton has given us a well illustrated account of the common marine forms of invertebrates with the methods of collecting them. The work is written in Mr. Emerton's straightforward manner, and from a literary point of view is superior to his well-known volume on spiders. A fair proportion of the 161 figures which illustrate the book are new, while the remainder have not been copied often enough to render them at all hackneyed. The pictures of *Lophothuria fabricii* and *Pentacta frondosa* are possibly the best. Here we would remark that the genera Callinectes, Lophothuria and Leptosynapta seem founded on decidedly insufficient grounds, and should be replaced by Neptunus, Peolus and Synapta. The book is well printed on good paper and forms a very handy volume for all seaside visitors, and would prove especially valuable to the many who throng our watering places and who wish to know something of marine life.

It might not come amiss to add here that this is the first volume published by Mr. Bates, the successor to Mr. Cassino in the Naturalist's Bureau at Salem, Mass, and that it reflects great credit on the publisher.—*J. S. K.*

ZITTEL'S PALÆONTOLOGY.[2]—The third part of Vol. I of this important work especially commends itself to American palæontologists, since it continues and completes the elaborate account of

[1] *Life on the Seashore, or Animals of our Coasts and Bays.* By JAMES H. EMERTON. 8vo, pp. xx and 143. Salem, George A. Bates, 1880.

[2] *Handbuch der Palæontology.* Unter mitwirkung von W. PH. SCHIMPER. Herausgegeben von Karl A. Zittel. I Band, III Lieferung, mit 195 original holzschnitten. München, 1879, 8vo.

fossil Echinoderms begun in the preceding part, and is partially based on the researches in this country of Hall, Billings, Shumard, Meek and Worthen and Wachsmuth, so that while the work is mainly compiled from European works and museums, the fauna of the two hemispheres is nearly equally well described and illustrated. The Crinoids are treated with fullness, the descriptions of the families and genera being preceded by more detailed accounts of the orders, while the essential features of the class are given at greater length, due reference being made to the structure of the hard and soft parts of the existing species. The Cystoidea and Blastoidea have received full and detailed treatment. The starfishes and sea urchins are described in the same manner, nearly as much space being given to the sea urchins as to the Crinoids. This part is illustrated by about two hundred woodcuts, nearly all well drawn and engraved. We do not know of a hand-book which will, when finished, be so useful for reference as this, at least so far as concerns the invertebrated animals and plants.

KOPPEN'S INJURIOUS INSECTS OF RUSSIA.[1]—While the literature of economic entomology is fullest in this country, where more perhaps has been done than in Germany, France or England, considerable attention is now being given to this subject in Russia, which of late years, especially last year and this, has suffered grievously from the ravages of noxious insects. To the author of this book we are indebted for the best, most detailed and original treatise on the migratory locust of the old world.

After briefly enumerating the insects found on the more important trees and crops, the insects of different orders are described or referred to. The treatment of the subject is scarcely adapted to the needs of the unlearned, but as the first sketch of so vast a subject, the book will indirectly be of much practical value to Russian agriculturalists.

MISS OMEROD'S ENGLISH INJURIOUS INSECTS.[2]—Though this is a pamphlet of but forty-four pages, yet the eminently popular style and the illustrations will render it most useful to the average English farmer and gardener. Though British agriculturalists are heavy losers by the attacks of destructive insects, for many years past there has been a strange apathy on the part of the entomologists in calling attention to these pests. Miss Omerod's annual reports and her earnest labors in economic entomology will, it is to be hoped, awaken fresh attention to a subject which from its very nature has to be re-worked every few years. Miss Omerod announces her intention to prepare a hand-book of remedies to be used in checking the ravages of insects destructive to

[1] *Die Schädlichen Insekten Russlands.* Von F. T. KOPPEN. St. Petersburg, 1880. 8vo, pp. 526.

[2] *Notes of Observations of Injurious Insects.* Report 1879. London, W. Swan Sonnenschein & Allen. London, 1880. 1 shilling. 8vo, pp. 44, with cuts.

the food crops, timber and fruit trees of England, and she has therefore issued a circular asking information concerning the habits, appearance and remedies against noxious insects.

WHITE'S CONTRIBUTIONS TO PALÆONTOLOGY.[1]—These chapters contain descriptions of fossils discovered by the Hayden Survey, belonging to the Cretaceous, Tertiary, Laramie, Triassic, Carboniferous, Jurassic and again the Carboniferous formations of the Western Territories, in the order here named. The sudden, and as it has proved in many ways to be, disastrous abolishment by Congress of this great survey, has left no provision for the proper publication of the final results of the geological and palæontological work. But while the subjects treated of in these eight contributions have been thus presented in an unfinished state, opportunity has been taken to figure nearly every species described in the publications of the survey. Hence all that refers to the Tertiary, Cretaceous, Laramie and Jurassic invertebrates, as well as those of other formations, is rendered of much value in future researches in Utah, Wyoming and Idaho. Perhaps the most valuable of the contributions are Dr. White's descriptions of the Laramie invertebrates and his general introductory remarks. These afford materials for a monograph of the invertebrate animals of this interesting formation which it is to be hoped he may have the opportunity, by fresh field work, to complete.

THE ABORIGINES OF VICTORIA.[2]—This valuable publication was printed at the expense of the government of the province of Victoria in Southeastern Australia, and although it professes to sketch only the natives of the province aforesaid, we get from it a glance at all the Australian aborigines, their manners, customs, and racial peculiarities. The first volume enlarges upon the manner of sustenance, the education of children and the mental character of these natives; then follow sketches of their encampments and daily life, their diseases, their canoes, weapons and other implements. A chapter on pictorial representations drawn on pieces of bark will attract particular attention.

The second volume is devoted to the reproduction of numerous vocabularies and other linguistic material of the Victoria and Tasmania dialects, all of which seem to show considerable affinity and are, in part, of a very harmonious, or at least vocalic character; follows a series of appendices of ethnographic import: songs, music, sign-language, etc. Some of the songs are worded in the harmonious dialect of Kotúpna, at the junction of Goulbourn and Murray rivers. Among the myths, of which a large selection is

[1] *Contributions to Palæontology.* Nos. 2–8. By C. A. WHITE, M.D. U. S. Geological Survey, F. V. Hayden in charge. (Extracted from the Twelfth Annual Report of the Survey for the year 1878.) Washington, July, 1880. 8vo, pp. 171, 42 plates.

[2] *R. Brough Smith, the Aborigines of Victoria.* Melbourne, 1878. Two volumes in Lex.-octavo, profusely illustrated.

offered, those of the creator of all things, called *Pundjel* by the tribes of Bungwrong, Yarra, Melbourne, &c., are of peculiar interest.—*A. A. Gatschet.*

Recent Books and Pamphlets.—The Foramina of Monro. By Burt G. Wilder. (From Boston Med. and Surg. Journ., Aug. 12, 1880.) pp. 8. From the author.

The two kinds of Vivisection—Sentisection and Callisection. By Burt G. Wilder. (From Med. Rec., Aug. 21, 1880.) pp. 2. From the author.

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On the Nipigon or Copper-bearing Rocks of Lake Superior, with notes on copper mining in the region. By J. W. Spencer. (From Canadian Naturalist.) pp. 15. From the author.

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Description of new species of Reptiles from Eastern Africa. By Dr. A. Gunther. pp. 5, Sept., 1880. From the author.

A contribution to the knowledge of the Fish-fauna of the Rio de la Plata. By Dr. A. Gunther. (From Ann. and Mag. Nat. Hist., July, 1880.) pp. 7, pl. 1. From the author.

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GENERAL NOTES.

BOTANY.

MECHANICAL CAUSE OF QUINCUNCIAL PHYLLOTAXY.—In a preliminary note on this subject, Prof. F. Delpino, of the Royal University of Genoa, describes the following experiment by which he has reached certain conclusions concerning phyllotaxy different from those usually adopted. Thirty or forty small spheres of equal diameter are fastened together as follows: the first, second and third are in contact; the fourth lies in the angle between them; the fifth is in the angle between the second, third and fourth; the sixth is in the angle between the third, fourth and fifth; and so on, each additional ball being placed in the angle between the three immediately preceding it in number. On the cylindroid thus formed the spheres occupy positions corresponding to those of the leaves in the quincuncial arrangement. Three spirals may be traced, having the formulæ $\frac{0}{1}$, $\frac{1}{2}$, $\frac{1}{3}$. Imagine now the spheres as thus placed to elongate gradually into horizontal cylinders, and the spirals will change successively to $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{5}$; $\frac{1}{3}$, $\frac{2}{5}$, $\frac{3}{8}$; $\frac{2}{5}$, $\frac{3}{8}$, $\frac{5}{13}$; &c. His conclusions are that the cause of the quincuncial arrangement is exclusively mechanical; that the orthostichous and retiseriate arrangements are not due solely to mechanical causes, but are influenced by physiological, biological and hereditary circumstances; that leaves are not peripheral and lateral, but central and apical in their origin; that the cauline system does not exist, what has been considered such being only a congenital fusion of the bases of an indeterminate number of leaves, and merely a region which he proposes to call the phyllopodium or phyllopodial region; that the structural principle governing the formation of the body (corpo) in the higher cryptogams, gymnosperms and angiosperms is the simplest possible, being a continued, more or less purely mechanical, ascendant apposition of similar organs; that the higher plants are phyllo-

phytes, and not cormophytes, the only true cormophytes being certain algæ (Caulerpa, Chara); and that the leaf has the same structural significance in the phænogams and higher cryptogams, but that there is nothing in the lower cryptogams which corresponds to it.—*W. T.*

INFLUENCE OF HIGH AND MOIST TEMPERATURES ON GERMINATION.—The action of high and moist temperatures on germination has been recently studied by M. Hackel, who put seeds of black mustard (*Sinapis nigra*) on a moist sponge placed in a plate whose bottom was constantly covered with water, and kept the whole in a stove with constant temperature at 48° C. In less than twelve hours radicles were formed in a large number of the seeds (but none such were observed in seeds in the water kept there—they never generated). The seeds, having sent out their radicle, stopped while the temperature remained at 48°, but when it was lowered to 20° or (better) 17.5°, there was a rapid development of germs. Neither *Sinapis alba* nor *Lepidium sativum* gave a reproduction of the phenomenon. The substances, benzoate of soda (known to arrest the development of ferments), benzoic acid and sulphurous acid, were proved to be capable of suspending the germination of various seeds.—*English Mechanic.*

NECTAR, ITS NATURE, OCCURRENCE AND USES. — Under this heading Mr. William Trelease contributes to the report on Cotton insects lately issued by the Agricultural Department, an interesting essay, accompanied by a good plate and full bibliographical references. He concludes that "nectar, whenever it occurs, may be considered as excretory, reproductive, protective or nutritive; that in some cases, *e. g.*, the leaves of the peach, excretory nectar may possibly be protective also; that reproductive nectar usually occurs in the flowers but not always; that protective nectar seems, in some cases, designed to keep ants from defoliating and deflowering the plant; in others, to keep larvæ from destroying the foliage or immature fruit; that nutritive nectar may serve, in some cases, to lead to the capture of wingless, in others of winged insects, and finally that the vital force of a plant is taxed so little in the production of nectar, that glands once developed and endowed with the power of active secretion may continue to secrete for generations after the necessity for their secretion has ceased to exist.

BOTANICAL NOTES.—At the Swansea meeting of the British Association, Mr. Alfred W. Bennett, in a paper on the classification of the Cryptogams, proposed to retain Sach's class of Protophyta for the lowest forms of vegetable life; but to restore the primary division of the remainder of thallophytes into Fungi and Algæ, as being more convenient to the student, and at least as much in accordance with probable genetic affinities. He also, with Mr. G. Murray, read an essay on "a reformed system of ter-

minology of the reproductive organs of the Cryptogamia."——At a recent meeting of the French Academy, M. Planchon described a new species of American vine under the name of *Vitis berlandieri*.——Messrs. E. A. Rau and A. B. Hervey have issued a Catalogue of North American Musci, giving the names of the species and the general localities.——A valuable contribution to the subject of insect-destroying Fungi has been published by Prof. A. Giard. Of these the most common is *Entomophthora muscæ*, so common in September and October in our apartments; a second type is *E. megaspermum*, a parasite of the cut-worm or larva of *Agrotis segetum*; others are *E. curvispora*, a parasite of *Simulium latipes*, a species of black fly, and *E. ovispora*, parasite of another fly (*Lonchæa vaginalis*). He regards Empusa and Tarichium as simply forms of Entomophthora, and to be used in the same sense as in zoölogy the nauplius or zoëa of a Crustacean. He describes as new a fungus parasite of the flesh fly, under the name of *Entomophthora calliphoræ*. He then describes the appearance of a gnat (Chironomus) attacked by the Empusa form of *Entomophthora rimosa*, and incidentally alludes to *E. conglomerata* of the mosquito. Finally M. Giard refers to the enormous services which Entomophthora renders to agriculture. "Nothing could be more easy than to multiply these parasites, and to introduce them into places where they had not hitherto existed." The caterpillars of the cabbage butterfly can be exterminated by watering them with water containing the spores of *E. sphærosperma*. By collecting, in winter, these caterpillars, mummified and filled with spores, they can be used in destroying the hordes of caterpillars of the next summer. Giard also recommends destroying the cut-worm by sprinkling over cabbage beds water holding the spores of the fungus in suspension.——Some peculiarities in the anthers of Clethra are described, by C. R. Barnes, in the *Botanical Gazette* for August and September.

ZOOLOGY.[1]

Eggs of the Tree Cricket wanted.—The undersigned would be much obliged for specimens of the eggs of the tree cricket (Œcanthus). They are laid in the terminal branches of the raspberry, plum, oak, grape, and almost any shrubs. The rows of punctures made by the ovipositor of the female are quite easily detected, and may be found during the Autumn and Winter. Send twigs by mail.—*A. S. Packard, Jr., Providence, R. I.*

Do Flying Fish Fly—In the September number of the Naturalist is a very interesting article on the subject, "Do Flying Fish Fly?" During the past summer I have been enabled to witness the flight of a good many flying fish of the large species

[1] The departments of Ornithology and Mammalogy are conducted by Dr. Elliott Coues, U. S. A.

known as *Exocœtus californicus* Cooper. The following extract from my field notes may be of some interest as bearing on this question:

It flies for a distance sometimes of nearly a quarter of a mile, usually not rising more than three or four feet. Its motions in the water are extremely rapid, and its motive power is certainly the movement of its powerful tail in the water. On rising from the water the movements of the tail are continued for some seconds until the whole body is out of the water. While the tail is in motion the pectorals are in a state of very rapid vibration, and the ventrals are folded. When the action of the tail ceases, the pectorals and ventrals are spread and, as far as we can see, held at rest. When the fish begins to fall, the tail touches the water and the motion of the pectorals recommences, and it is enabled to resume its flight, which it finally finishes by falling in the water with a splash. When on the wing it resembles a large dragon-fly. The motion is very swift; at first it is in a straight line, but this becomes deflected to a curve, the pectoral on the inner side of the arc being bent downward. It is able to some extent to turn its course to shy off from a vessel. The motion seems to have no reference to the direction of the wind, and we observed it best from the bow of a steamer off Santa Catalina island, in early morning, when both air and water were free from motion.—*David S. Jordan, Ind. State Univ., Bloomington, Ind.*

Flights of "Flies."—Under the head of "traveling flies," the *Scientific American* notices the occurrence of a vast cloud of flies on the Hudson river, between New Hamburg and Newburg. It reached southward from shore to shore as far as the eye could reach, and resembled a great drift of black snow. The insects were flying northward "as thick as snow flakes driven by a strong wind." The steamer *Mary Powell* ran into the fly storm off Haverstraw, some forty miles below where the *Martin* encountered it. The flies were "long and black and had light wings."

A dispatch from Halifax, Nova Scotia, states that on Sunday, Sept. 5, immense swarms of flies passed over Guysboro, 120 miles northeastward of Halifax. They came from the east and resembled a dark cloud.

A correspondent of the Toronto *Mail*, writing from East Pictou, Nova Scotia, describes a similar phenomenon as occurring there August 21. The flies, forming a veritable cloud, passed Lismore at 6 o'clock in the evening, close to the shore. They went with the wind, which was blowing lightly from the west, occupying about twenty minutes passing a given point. They made a loud, buzzing noise, which was heard by many who missed seeing them. They flew so low that some of them appeared to fall into the water. About two miles below Lismore they slightly changed their flight, heading more to the north.

CETONIA INDA.—This common insect which in former years was a harmless beetle feeding in early spring on the sap of freshly cut maple trees has, within two or three years, become very abundant and destructive in different parts of New England. During the past summer it collected in great numbers on green corn, eating the kernals and partly destroyed a field in Middleboro, Mass., as we learn from Prof. Jenks.—*A. S. P.*

CAUSE OF THE TWISTING OF SPIRAL SHELLS.—At the end of his essay on the development of the pulmonate Gasteropods, M. Fol inquires into the cause of asymmetry of univalve shells; by most authors it has been ascribed to the folding round of the shell; Ihering, however, regards the torsion of the shell as due to the asymmetry of the viscera. Fol regards both these opinions as too extreme, as in the Heteropoda asymmetrical arrangements manifest themselves at an extremely early period. In Helix and Limax the torsion does not appear so early, and is seen simultaneously in the viscera and in the shell. To explain the phenomena, it seems to be necessary to note the process of segmentation of the ovum; but here unfortunately there is but little information. The fact that organs like the kidneys, which are, as we know, primarily double, are in the youngest of Gasteropod larvæ, single, seems to show that the asymmetry is produced prior to the commencement of the embryonic period. In conclusion, as reported in the Journal of the Royal Microscopical Society, the author points out how recent observations tend to favor the reëstablishment of the *Vermes* of Linnæus. It is impossible, Fol says, to compare the molluscan larva with a segmented worm larva; they only correspond to the cephalic portion of the larva of an Annelid, or to an entire Rotifer; the Mollusca are not segmented animals which have fused their segments, but they are animals which have remained simple. In the Vermes, on the other hand, the larval form (Lovenian, veliger, trochosphere) can, with variations in form, be traced through "worms," Annelids, Bryozoa, Brachiopods, and even Echinoderms, and these all form a phylum quite distinct from that of the Arthropoda on the one hand, and of the Chordata (Tunicata and Vertebrata) on the other.

THE YOUNG OF THE CRUSTACEAN LEUCIFER, A NAUPLIUS.—One of the most interesting observations which we have made this summer is, that Leucifer leaves the egg as a Nauplius. As Fritz Müller did not raise the young of Peneus, but relied upon surface collecting, his observations are not absolutely conclusive, but I have seen Leucifer lay its eggs, and I have seen the exit of the Nauplius from the egg, so the occurrence of a Nauplius is proved, absolutely, in one stalk-eyed Crustacean.

As almost nothing was known about the habits of Leucifer, and nothing whatever about its embryology, I have devoted especial

attention to this interesting species this summer, but although the animals are very abundant I have been baffled in all my attempts to find the eggs or young until within the last week, but have now got on to the right track, and can get a complete history if the weather is calm for a week longer.

The animals are remarkably regular in their breeding habits. They copulate late in the afternoon; the eggs are laid about nine o'clock in the evening, and they hatch in about thirty-six hours. The eggs are attached very loosely in an irregular bunch of about twelve or fourteen, to the last pair of thoracic appendages. They fall off at the slightest touch, and this, together with the rapidity of their development, explains the failure to find them in specimens collected at the surface. As they do not flourish in confinement, the eggs cannot be procured in any quantity from captive specimens, and until their breeding habits were known, the investigation presented great difficulties. By going out about eight o'clock on a calm evening and dipping very carefully with a hand net, a great number of individuals may be procured, and if these are carried home with great care and left undisturbed until about ten o'clock, careful examination will then show that several specimens have bunches of new-laid unsegmented eggs. If these specimens are carefully picked out, and placed by themselves, they can be kept, without much difficulty, until the eggs hatch, on the second morning after the adults were collected.

The course of development is of unusual interest, as Leucifer, like Amphioxus, presents what must be regarded as an unmodified embryonic history. Segmentation is total and perfectly regular, and the cells double their number at each cleavage, even after they have become very small, and many hundreds in number.

There is a true invaginate gastrula, which is as beautifully simple, and unmodified as the well-known gastrula of Sagitta.

The Nauplius is a typical nauplius, very much like that of a barnacle, or that of Cyclops, and is a marked contrast to the peculiar and specialized Nauplius of Penæus. If I had not seen it hatch I should certainly have supposed it to be a Copepod embryo, as the resemblance is perfect.

In this connection I may state that Mr. Wilson has succeeded in raising zoëas from the eggs of Libinia, and of a closely-allied genus. In these, the most highly specialized of the Decapods, the embryonic record is accelerated so much that the zoëa has its full number of thoracic appendages when it leaves the egg, so the embryology of Leucifer is at one end of the series and the embryology of Libinia at the other.

Wilson has also raised the zoëas of the following crabs from the egg, this summer: Porcellana, Pinnixa, Sesarma, Pinnotheres, Callinectes.

The skin which the crab zoëa sheds soon after it leaves the egg has been regarded as a Nauplius skin, but the fact that the Naup-

lius of Leucifer leaves the egg encased in a simiiar skin, and molts it soon after, seems to indicate that it has no morphological significance.—*W. K. Brooks, Beaufort, N. C., Sept. 5.*

THE FRIGATE MACKEREL, AUXIS ROCHEI, ON THE NEW ENGLAND COAST. — The United States Fish Commission has obtained numerous specimens of a fish, before entirely unknown in the Western Atlantic. This is the frigate mackerel, *Auxis rochei*, twenty-eight barrels of which were taken in a mackerel seine, ten miles east of Block island, on the 3d of August, by the schooner *American Eagle*, Capt. Josiah Chase, of Provinceton, Mass.

The Frigate mackerel resembles in some particulars the common mackerel, in others the bonito; the genus Auxis being intermediate in its character between the Scomber and the related genera Pelamys and Orcynus. It has the two dorsal fins remote from each other as in Scomber, and the general form of the body is slender, like that of the mackerel. The body is, however, somewhat stouter, and instead of being covered with small scales of uniform size, has a corselet of larger scales under and behind the pectoral fins. Instead of the two small keels upon each side of the tail which are so noticeable in the mackerel, it has the single more prominent keel of the bonito and the tunny. Its color is grayish-blue, something like that of the pollack, the belly being lighter than the back. Under the posterior part of the body, above the lateral line, are a few cloudings or maculations resembling those of the mackerel. The occurrence of a large school of this beautiful species in our waters is very noteworthy, for the fish now for the first time observed are very possibly the precursors of numerous schools yet to follow. It is not many years since the bonito became an inhabitant of our waters, and the distribution and habits of the frigate mackerel are supposed to be very similar to those of the bonito, *Sarda pelamys*, and the little tunny, *Orcynus alliteratus*, which also first came on the coast in 1871, and have since been found in considerable numbers.

The frigate mackerel has been observed in the West Indies and other parts of the tropical Atlantic as well as on the coast of Europe. In Great Britain it is called the "plain bonito." It is not unusual in the Bermudas, where it is called the "frigate mackerel," a name not inappropriate for adoption in this country, since its general appearance is more like that of the mackerel than the bonito, while in swiftness and strength it is more like the larger members of this family.

Since the first appearance of this fish many new observations of its abundance have been received. These fish seem to have come in immense schools into the waters between Montauk point and George's bank, and from Mr. Clark's statements it appears that they have been observed in small numbers by fishermen in previous years. Several vessels have come into Newport recently, reporting their presence in immense numbers in the

vicinity of Block island. It will interest the "Ichthyophagists' Club" to know that several persons in Newport have tested the fish, and pronounce it inferior to the bonito. Part of the flesh, that on the posterior part of the body, is white, but behind the gills it is black and rank, while the meat near the backbone is said to be of disagreeable, sour flavor.

It is hard to predict what its influence will be upon other fishes already occupying our waters. Its mouth is small and its teeth feeble, so that it is hardly likely to become a ravager like the bonito and the bluefish. There is little probability, on the other hand, that its advent will be of any special importance from an economical point of view, for its oil does not seem to be very abundant, and it would hardly pay at present to capture it solely for the purpose of using its flesh in the manufacture of fertilizers.

Mr. A. Howard Clark, in charge of the Fish Commission station at Gloucester, has communicated to Prof. Baird some interesting facts regarding its abundance. From these statements it would also appear that the species has been observed occasionally in past years. He writes under date of August 10th: "I have received this morning from the schooner *Fitz J. Babson*, just arrived from Block island, a fish answering to your description of the Auxis, having a corselet of scales around the pectoral fin as in the tunny. The captain of the vessel, Joshua Riggs, reports that about a week ago he had a hundred barrels in the seine at one time, and saw over twenty schools of them. He saw them as far east as Sow-and-Pig light ship. They are very easy to catch, flip like menhaden, do not rush, and are not frightened at the seine. They go in immense numbers, he thinks, as many as one thousands barrels to a school. The day after the appearance of these fish the mackerel disappeared, but he does not know whether the mackerel were driven away by them or not. They feed on mackerel food. Mr. Daniel Hiltz, of the same vessel, says that he caught one of just the same kind in February, 1879, on a haddock trawl on the eastern part of the Middle Bank in forty fathoms of water. He took it to Boston, where it was called a young bonito."

Mr. John Henderson, of the schooner *Sarah C. Wharf*, says that two vessels caught such fish recently, eastward of here; the schooner *American Eagle*, of Provincetown, took a number of barrels of them into Newport, and sold them for a dollar a barrel. Another Cape Cod vessel, he does not know her name, took about fifty barrels of them and threw them away. All the mackerel seiners from Block island report seeing quantities of this new fish within the past fortnight. The captain of the schooner *Sarah C. Wharf* says he first saw them a fortnight ago some fifteen miles off Block island. The captain and several of the crew of the *Ella M. Johnson*, of Newburyport, just arrived from Block island, state they saw abundance of the Auxis, but did not know what it was

until reports came from you at Newport. They opened one and found in its stomach the ordinary red mackerel food. This crew differ with the crew of the schooner *Fitz. J. Babson* with regard to the ease of capturing them—think them rather difficult to take; say they flip like porgies, and do not rush like mackerel; they saw ten large schools of them on Saturday last when some fifteen miles south of Block island.

I hope that any reader of the AMERICAN NATURALIST who has seen this fish will mention it; some may, perhaps, have an opportunity of studying its habits. The length of those I have seen ranges from twelve to sixteen inches, and their weight from three-quarters of a pound to a pound and a-half or more. Those sent to New York market were part of the lot taken by the schooner *American Eagle* and brought into Newport, whence they were shipped by Mr. Thompson, a fish dealer of this place. It would require from eighty to one hundred of them to fill a barrel, so the estimate of Capt. Riggs that there are a thousand barrels in one of the schools, shows how exceedingly abundant they must be.

Capt. N. E. Atwood, of Provincetown, Mass., the veteran fisherman-ichthyologist, has examined the specimens, and is satisfied that they belong to the same species as fish which he found abundant in the Azores in 1840, when, led by the reports of Cape Cod whalers, he went to these islands in search of mackerel, the mackerel fishing being poor at home. No mackerel were found except the "frigate mackerel" referred to in this note.—*G. Brown Goode, Summer Station U. S. Fish Com., Newport, R. I., Aug. 30, 1880.*

ON THE OCCURRENCE OF FREIA PRODUCTA WRIGHT, IN THE CHESAPEAKE BAY.—Sometime in 1851 Prof. Leidy called attention to the existence of *Freia ampulla* in American waters, and from the poor figures of the European form then in existence, he was led to consider it a new species under the name of *F. americana*, but he now considers both forms the same. As they are amongst the most singular and beautiful of the family of the trumpet animalcules or Stentorina, I take pleasure in announcing that I have found the still more interesting species, *F. producta* T. S. Wright, in shallow waters on the western shore of the Chesapeake, attached in vast numbers to the shells of oysters, in company with ? Loxosoma and other bryozoa.

The tubes in which the animalcule resides are formed of a narrow transparent ribbon of horny consistency, wound into a spiral and terminating in a trumpet-shaped extremity from which the odd peristome of the inhabitant protrudes. The basal or attached end of the tube is usually bent at an angle to the tube and bears a striking resemblance to the foot end of a stocking fastened to some other object by the surface on which the sole rests. This portion is not composed, like the tube, of a spiral ribbon, but is simply a thin-walled sac, from the open end of which the ribbon

takes its rise, but it is composed of the same kind of material. Many of the tubes show the rim of a trumpet projecting from the sides of the former, a little above the middle, and of the same form as the terminal rim, showing that this, like the form described by Mr. Wright from English waters, may stop building its tube for a time and then recommence.

The adult animal, tube and all, when fully extended, will measure $\frac{1}{25}$ of an inch in length. It is of the same color as *Stentor cœruleus*, but has the power of elongating and twisting itself as greatly as *S. rœseli.* The peristome is quite unlike that of *Freia ampulla* and bears a strong likeness to the blades of a pair of obstetrical forceps. The blades are deeply grooved, forming a deep ciliated demi-canâl with parallel sides, and at the junction of their bases lies the spacious, twisted and richly ciliated pharynx, which is bounded dorsally and ventrally by the prominent folds which unite on either side with the long, curved lobes of the peristome. As in *F. ampulla* a finger-shaped knob, which may sometimes be extended as a long flexible appendage, surmounts the apices of the lobes of the peristome. There is a small basal disc as in Stentor and the ectosarc is traversed as in that genus by parallel granular bands, regarded as muscle fibers by some writers. The usual food balls and vacuoles are present, and I was enabled to define sharply the endosarc from the ectosarc, and clearly see the long-beaded nucleus. The tube or ribbon-secreting organ described by Wright I was unable to discover.

When fully extended the basal portion of the animal becomes attenuated to a thin bluish filament, which widens toward the peristome, where the body is over half as thick as the diameter of the tube. When fully retracted and resting, the animal resembles in its oblong shape a retracted and resting Stentor, and measures about $\frac{1}{10}$ as long as when fully extended. The agreement of this form with *F. producta* is in every respect so complete, that I have no doubt whatever that they are the same. The ribbon makes from four to twenty-four turns in specimens of different ages, and the turns are to the right. *F. stylifer* Wright, is probably only a variety of this species.—*John A. Ryder, Sept. 3d, 1880.*

Rhipidodendron splendidum.—This remarkable flagellate monad, which builds a fan-shaped test composed of radiating tubes in which the individuals live and divide, is not uncommon, attached to the leaves of Sphagum, from ponds in the neighborhood of Woodbury, N. J., from whence I have obtained it in material furnished me by Mr. W. P. Seal. Prof. Stein first described it from Bohemian waters.—*J. A. Ryder.*

A Pale Variety of Polyxenes fasciculatus.—I have just picked up some specimens of Polyxenes that seem to me unusually pale in color. I find them under chips, sticks and bits of bark within forty feet of the sea beach, at St. Jerome, St. Mary's

county, Md., on the Chesapeake bay. The beach at this place is composed of white sand, and these little myriapods seem to have acquired a reddish tinge with none of the bluish cast so characteristic of specimens which I have examined from the vicinity of Philadelphia. There is so little pigment in the body walls that with careful illumination I am able to see the viscera, filled with ingesta, very plainly. There are no other differences by which I can distinguish the form from *P. fasciculatus* Say. It may be called var. *pallidus*.

I wish also to record that all the inland specimens which I have found were always observed under the bark of trees, a fact which, I think, Mr. Say also records, but these I find invariably on the ground and in great numbers underneath the objects mentioned. —*J. A. Ryder.*

Zoological Notes.—A communication has been found by F. W. Bennett between the air-bladder and the cloaca in the herring. ——The structure of the ovary, ovulation, fecundation and the first stages of development in the bats has lately been studied by Messrs. Van Beneden and Julin. A contribution to the study of the structure of the ovary of the mole, ermine and bat (*Vesperugo pipistrella*) by J. MacLeod, appears in Van Beneden and Bambeke's Archives de Biologie.——A good deal of attention is now being paid by anatomists to the nervous system of the lower animals, especially the ganglionic centers. A useful tract bearing on this subject is Liénard's " Constitution de l'Anneau Œsophagien." ——Mr. J. A. Lintner's Lepidoptera of the Adirondack region is an interesting contribution to zoö-geography, especially to our knowledge of the sub-arctic life of these mountains. It appears in the seventh report of the Adirondack Survey.——The researches carried on by the U. S. Fish Commission the past season from Newport out to the Gulf Stream, have resulted in the addition of a large number of new fishes and marine invertebrates. The hauls made in about three hundred fathoms under the edge of the Gulf Stream revealed a strange mixture of tropical and arctic life, with abyssal forms, including many shells and an interesting new starfish; 150 species new to the coast being dredged in a single day.——M. Fabre has discovered that two species of Halictus, a genus of bees, are parthenogenetic. They have two generations a year; a vernal and sexual one, originating from females which, fecundated in autumn, have passed the winter in their cells; the other æstival and due to parthenogenesis. From the union of the two sexes females alone develop; from parthenogenesis a brood of both females and males result. Aside from the Aphides these bees are, Fabre claims, the first example known of a sexual generation alternating with reproduction without union with a male.——A remarkable form of Pedicellaria and the functions performed thereby are described by W. P. Sladen in the Annals and Magazine for August.——Villot, after further

study of the hair worms now asserts that the larvæ of the Gordii do not select their hosts; they encyst themselves and become developed in the most different animals (batrachians, fishes, crustaceans, Arachnida, insects and mollusks). It is, therefore, by no means the case that the larvæ of the hair worms are parasites peculiar to insects; they probably most frequent fishes, and only exceptionally infest terrestrial animals, and only these when accidentally exposed to water, many insects, as ground beetles, mantidæ, grasshoppers and locusts perishing in this way; the Gordii in them being set at liberty.

ANTHROPOLOGY.[1]

The Anthropological Society of Washington.—On the 10th of February, 1879, at the invitation of Dr. J. Meredith Toner, Col. Garrick Mallery, U.S.A., and Prof. Otis T. Mason, a few gentlemen interested in the study of man, met in the Smithsonian Institution to devise a method of mutual improvement. The effort resulted in the formation of the Anthropological Society of Washington, with Maj. J. W. Powell for president, Dr. Elmer R. Reynolds, recording secretary, and Otis T. Mason, corresponding secretary. The purpose of the members being to compare notes upon their different fields of research, the organization had no pretentious designs. It is not yet decided whether the journal will be published, inasmuch as the Smithsonian Institution and the Bureau of Ethnology afford ample opportunities of preserving all papers of permanent value.

The following is a list of papers read from the foundation of the society to the end of the year 1879:

1. Indian Pictographs. G. K. Gilbert.
2. Aztec and Guatemalan Antiquities. Otis T. Mason.
3. Arrow-making. Frank H. Cushing.
4. Color Blindness. Dr. Swan M. Burnett.
5. Prehistoric Archæology. Wills de Hass.
6. Indian Color Names. A. S. Gatschet.
7. Indian Pictographs. Miles Rock.
8. French and Indian Half-breeds. Dr. Victor Havard, U.S.A.
9. Indian Color Names. Albert S. Gatschet.
10. Comparative Mythology of the Indies. Col. Garrick Mallery, U.S.A.
11. Aboriginal Cemeteries near Piscataway, Md. Dr. Elmer R. Reynolds.
12. The Zoölogical Relationship of Man. Prof. Theodore N. Gill.
13. The Sign Language of the N. A. Indians. Col. Garrick Mallery, U.S.A.
14. Poisoned Weapons of the N. A. Indians. Dr. Wm. J. Hoffman.
15. Fertilizers employed by the N. A. Indians. G. Browne Goode.
16. Comparison of a written language with one that is spoken only. Otis T. Mason.
17. Aboriginal Shell Mounds at Pope's Creek. Dr. Elmer R. Reynolds.
18. Ancient Maps of N. America. John C. Lang.
19. Comparison of Forest and Geological changes in the Tropics. Miles Rock.
20. Estimation of the age of Prehistoric Remains. Capt. Edwin P. Lull, U.S.N.
21. Turtle-back Celts and their Uses. Dr. Elmer R. Reynolds.
22. Aboriginal Shell-heaps on South River, Md. J. D. McGuire.
23. Unclassed Disc-shaped Implements from Benning's, D. C. Dr. Elmer R. Reynolds.
24. A Strange old Chart. Lt. Com. W. Bainbridge Hoff, U.S.N.

[1]Edited by Prof. Otis T. Mason, Columbian College, Washington, D. C.

THE DAVENPORT ACADEMY.—The Academy of Natural Sciences of Davenport, Iowa, has just issued Part II of Vol. II, from July, 1877, to December, 1878, and Part I Vol. III, to January 1, 1879. Wherever Prof. J. D. Putnam and Dr. C. C. Parry are to be found, one reasonably expects to hear of entomology and botany, and the volumes before us are largely indebted to these gentlemen for what they contain of lasting value. A goodly space, however, is devoted to what immediately concerns this department, as the following list of papers will show:

VOL. II:

Exploration of Mounds on the farm of Col. Wm. Allen. W. H. Pratt.
Examination of a large Mound in Jackson county, Iowa. Rev. J. Gass.
A review of the published statements regarding the Mound at Payson, Utah. By Dr. E. Palmer.
Inscribed Rocks in Cleona Township. Rev. J. Gass.
Report on the Mounds of Jackson County. Rev. J. Gass.
Left-handedness in the City Schools. W. H. Pratt.
Mound No. 11, Cook's farm, and an Inscribed Tablet. C. E. Harrison.
The Shell Mounds of Florida. W. W. Calkins.
Curious relic from the Cook farm. W. H. Pratt.
On the East Davenport Mounds. A. D. Churchill.
Mound near Moline, Ill. Rev. J. Gass and Dr. R. J. Farquharson.
Exploration of Indian Graves. Rev. J. Gass.
Elephant and Bear Pipes, illustrated.

Most of these communications are, for the present of local interest. The time will soon come, however, when these special labors will be generalized into a consistent system embracing the archæology of our entire continent. On pages 156–162, Vol. II, Mr. Pratt describes shell beds in the vicinity of Davenport, which he considers to be of natural formation. It would be well for some of our shell-heap friends to look into the matter. To discover that natural causes had coöperated with man in building mounds and shell heaps, would affect materially our theories concerning both. Dr. Palmer, pages 167–172 takes entirely too much notice of a canard concerning giants and mummy wheat. The description of the mode of building up the mound is excellent, and Dr. Palmer has the credit of being the first to draw attention to these tent mounds. It is to be sincerely hoped that no respectable journal will hereafter help to propagate archæological weeds. The short paper by Mr. W. H. Pratt on left-handedness, p. 186, is an excellent contribution to a special subject. The paper of Mr. Harrison, pages 221–224, touches on a topic of absorbing interest. The late Prof. Henry was in the habit of calling all observations which did not readily fall into some known class, outstanding phenomena. The tablets of Davenport and the more recently discovered elephant pipes are, at present, outstanding phenomena. We may provisionally enumerate the groups of objects in one of which they must go: 1. It has been said that they are downright frauds. The veracity of the many scientific gentlemen in the Academy which has been staked upon the genuineness of the finds, forbids such a conclu-

sion. 2. In a late number of the *American Art Review*, Mr. F. W. Putnam draws attention to an Egyptian idol in a Florida mound, and after weighing the evidence, inclines to believe it a "plant." If the Davenport tablets and pipes are clever "plants," some very shrewd gentlemen have been hoaxed, but really it is unkind to harbor such thoughts if there is any other possible explanation of the phenomena. 3. While many of the mounds of this continent are of unknown antiquity, it is proved beyond a doubt that many are quite recent. It is within the range of possibility that the mounds at Cook's farm were constructed after the Indians had received from the Catholic missionaries an idea of recording events upon bark, stone, metal, etc. 4. Granting the Asiatic origin of the Mound-builders, it is not inconceivable that the recollection of the elephant and of written characters, which play such a prominent part in the civilization of Asia, should have been brought to this continent and permanently recorded in stone. 5. It is yet an open question whether man existed on this continent contemporaneously with the mastodon, or, what amounts to the same thing, whether the mastodon survived until man had appeared in America. If such had been true, we have in our elephant pipes another graphic witness of this acquaintanceship. 6. The theory that these graphic signs and images are only undesigned coincidences will close our list of conjectures for the present regarding these truly wonderful objects. The paper of Mr. Calkins on the Florida Shell-mounds has interested us very much. This branch of archæology is now being thoroughly worked up by Le Baron, Gilman, Walker and others, under the patronage of the Peabody Museum and the United States Fish Commission. The latest testimony is rather unfavorable to the cannibal theory.

ANTHROPOLOGY IN FRANCE.—The second number of the *Revue d'Anthropologie* for 1880 is up to the standard both in its original articles and in its reviews. The following list of original papers shows how completely the area of anthropology is covered by our colleagues in France: Essai d'Anthropométrie (comparison of the bi-trochanterian diameter of the human body with the bi-iliac diameter) by Charles Féré; Essai sur les méthodes numériques qui permettent d'apprécie la fécondité et la vitalité, by Charles Richet; Sur la transformism, by Dr. Périer; Recherches anthropometriques sur les effets de la gymnastique d'entraînement, by Drs. Chassange and Dally; Ethnologie du Portugal, by M. J.-J. Da Silva Amada.

The observations of Dr. Féré were made upon 133 males and 67 females. Without attempting to repeat his processes, we may give some of the author's results. There is no fixed relation between the width of the skull and of the pelvis, notwithstanding M. Pruner-Bey thinks that the form of the cranium agrees with that of the thorax and of the pelvis in well marked races. Again, while the proportions of the diameter of the skull and of the bi-

acromial diameter decrease gradually and in a quite regular manner in both sexes as the height increases, and they are generally less in females, the bi-iliac and the bi-trochanterian diameters present numerous variations. Dr. Richet, in his paper on fecundity, discusses the relation of vitality to fecundity by means of a series of algebraic formulæ. The chief merit of the communication is the emphasis given to the fact that the mere counting of the offspring of a single generation of mulattoes is not a correct guide to their fecundity. It is well known that very feeble mothers frequently have many children, all of whom perish in childhood, while vigorous mothers, less fecund, raise all their children, and thus contribute to the succeeding generation a proportional number of fathers and mothers. It will be seen at once that the question of the permanence of hybrids depends quite as much on the vitality of the offspring as upon the fecundity of the mothers. Dr. Périer, in his note on evolution, calls attention to the fact that the theory of "transformism" has been received with greater enthusiasm in England and Germany than in France, the land of its birth. The author inclines to compliment his countrymen for this state of things, and, for himself, is happy "to be among the number of those who bow before the inaccessible unknown, and who prefer the philosophic doubt to conceptions however lofty they may be, which are, after all, only learned errors." The following paper on anthropometry applied to gymnastic training treats of that practical side of our science which answers the question *cui bono* asked every minute by those practical people who have the bills to pay. The investigations reported were made at the military school of Joinville, and are divided into three classes: 1. Gymnastic anthropometry, or determination of the development of the thorax, muscles, and dynamics by gymnastic exercises; 2. Military anthropometry, or the determination of thoracic and muscular development by normal military exercises, or life in the regiment; 3. Professional anthropometry, or researches upon the mean development of the thorax, muscles, and dynamics produced by professional or civil life. To these are added, verification of the law of the relation of weight to the number of centimetres above a metre in stature; mean dynamic force, general and special, of men at twenty-three years of age; conclusions and the demonstration of the utility of gymnastic practice in the barracks and in the school. A bibliographic list accompanies the essay and adds very much to its value.

ANTHROPOLOGY IN ENGLAND.—The May number of the *Journal of the Anthropological Institute* contains, in addition to the president's address, the following papers of general interest: Australian marriage laws, by Rev. Lorimer Fison; Savage and civilized warfare, by J. A. Farrer; Notes on the Jivaros and Canelos Indians, by Alfred Simson; On the Bheel tribes of the Vindhyan

range, by Col. W. Kincaid; The Ethnology of Germany, Part IV: the Saxons of nether Saxony, Section II, by H. H. Howorth.

Mr. Tylor's address is a model for all such orations. Going beyond the custom of his predecessors, he commences with a tribute to the work of foreign societies, but, alas, finds no good word for American laborers. Following this we are presented with a résumé of work done by British anthropologists. Mr. Fison, in a letter to Mr. Tylor, gives a detailed statement of class marriages in Australia, accompanied with a chart. Mr. Farrer develops the idea that among savage races there are laws of war; that the instances are rare "where no notice nor declaration of war is made, but one tribe falls on another with no more warning than would be considered obligatory by a pack of wolves." The tribes described by Mr. Simson dwell in Ecuador. The author has been for years a resident of the country, and speaks from personal observation. The Bheel tribes described in Col. Kincaids paper live on the hills and in the villages bordering on the Vindhya mountains, a range stretching across Hindostan from east to west, just north of the Nerbudda river, extending from 22° to 25° N. The village Bheels are employed by the people among whom they dwell as trackers of stolen property, which custom is well described by the author, as well as the methods of oath taking, superstitions and marriage ceremonies.

Mr. Howorth's paper occupies thirty pages of the *Journal* and is a continuation of the author's exhaustive monographs upon the tribes inhabiting Europe in the earliest classical times.

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GEOLOGY AND PALÆONTOLOGY.

GEOLOGY OF EGYPT AND OF THE LIBYAN DESERT.—Prof. Carl Zittel has published in the Abhandlungen of the Royal Academy of Munich for 1880, an essay on the above subject. It is largely based on the observations and collections of Schweinfurth and Güssfeld. As is known, the order of succession of the formations in Northern Africa is from the older in the south to the later in the north. An exception to this is found in the region bordering the Red sea, where a long extension northward of the primitive Azoic formation exists. Dr. Zittel shows that the greater part of the region west of this primitive plateau consists of the upper and lower Nummulitic Eocene. To the south and southwest the Cenomanian Cretaceous comes to the surface, the lower beds especially appearing from beneath lines of Eocene or upper Cenomanian bluffs. The oases are excavations in the latter formations, whose bottoms consist of the Lower Cenomanian.

VERTEBRATE PALÆONTOLOGY OF INDIA.—Dr. Lydekker continues to make important contributions to this subject. His latest is a memoir on the Siwalik and Narbada Proboscidia, in which a great deal of light is thrown on the structure of the dentition of many of the species. Two species are named for the first time, *Dinotherium sindiense* and *Mastodon falconeri* (a trilophodont), while several others are described for the first time under MS. names of Falconer. In a preface the author puts the Indian species of *Rhinoceridæ* in order, and gives information not hitherto accessible, by which they may be referred to their proper genera.

In the Journal of the Asiatic Society of Bengal for 1880, Dr. Lydekker gives a synopsis of the species of extinct Vertebrata hitherto found in the peninsula of India. He enumerates twenty-eight species of fishes, mostly Palæozoic; seventeen of Selachii, mostly Mesozoic; thirty-nine Reptilia and Batrachia, divided

equally between the Mesozoic and Tertiary, and one hundred and twenty-five Mammalia.

THE GEOLOGY OF THE LOWER VALLEY OF THE DELAWARE.—Mr. H. C. Lewis has recently investigated this subject, and presents us with the following résumé of his results in the Proceedings of the Philadelphia Academy:

Forming the N. W. boundary of the Philadelphia gravel and brick-clay is a hill of gneiss, rising two hundred feet or more above the river, which may be called the Upland Terrace. It has a N. E. and S. W. trend, and in this vicinity is at an average distance of five miles from the river.

Within the Upland Terrace, resting upon its slope and extending to the river, is a series of stratified gravels and a boulder-bearing brick-clay. Of these the oldest is the "Fossiliferous gravel;" a gravel lying near the terrace and under the brick-clay, and containing pebbles which frequently are fossiliferous. Of more recent age, and at a lower level, is the "Philadelphia red gravel," which is made up of the pebbles of the Fossiliferous gravel mixed with fragments of Triassic red shale and other rocks brought down the Delaware valley. It is distinctly stratified, rests upon decomposed gneiss, and contains rounded boulders dropped by floating ice. Upon both of these gravels rests the Philadelphia brick-clay, often lying unconformably upon them in a series of pot-holes or wave-like forms, and apparently an aqueous deposit.

A yet more recent formation, the "River gravel and sand," lies within the others and close to the river, and is made up of flattened pebbles composed of the rocks over which the river flows. Upon this, in the river flats, lies a modern mud, the "Recent Alluvium."

Back of the Upland Terrace, isolated patches of two surface deposits, more ancient than any yet described, lie upon the hills. These are, the "Branchtown clay," at a height of two hundred and fifty feet, containing boulders of Potsdam rocks but no traces of Triassic red shale or of fossiliferous pebbles; and the "Bryn Mawr gravel," which caps hills of a higher elevation, and which, containing boulders and pebbles of identical material with those of the last, is characterized by the presence of a hard iron conglomerate or sandstone. This conglomerate, occurring also in New Jersey, and named the "Mt. Holly Conglomerate," is conjectured to be of Tertiary age.

In these seven formations is written the geological history of the Delaware valley.

ORIGIN OF CORAL REEFS AND ISLANDS.—*Nature* for August 12th contains a suggestive essay on this subject by Mr. John Murray of the Challenger expedition. His views do away with the great and general subsidences required by Darwin's theory,

and are in harmony with Dana's views of the great antiquity and permanence of the great ocean basins, which all recent deep-sea researches appear to support. Murray thus summarizes his views:

1. That foundations have been prepared for barrier reefs and atolls by the disintegration of volcanic islands, and by the building up of submarine volcanoes by the deposition on their summits of organic and other sediments.

2. That the chief food of the corals consists of the abundant pelagic life of the tropical regions; and the extensive solvent action of sea water is shown by the removal of the carbonate of lime shells of these surface organisms from all the greater depths of the ocean.

3. That when coral plantations build up from the submarine banks they assume an atoll form, owing to the more abundant supply of food to the outer margins, and the removal of dead coral rock from the interior portions by currents and by the action of the carbonic acid dissolved in sea water.

4. That barrier reefs have built out from the shore on a foundation of volcanic débris or on a talus of coral blocks, coral sediment, and pelagic shells, and the lagoon channel is formed in the same way as a lagoon.

5. That it is not necessary to call in subsidence to explain any of the characteristic features of barrier reefs or atolls, and that all these features would exist alike in areas of slow elevation, of rest, or of slow subsidence.

In conclusion it was pointed out that all the causes here appealed to for an explanation of the structure of coral reefs are proximate, relatively well known and continuous in their action.

THE "COMPTES RENDUS STENOGRAPHIQUES" of the Congress of Geologists, held in the Trocadero Palace during the Exposition of Paris of 1878, has just appeared. It is an octavo volume of over 300 closely printed pages. These include forty memoirs with the related discussions. Seven articles are by Americans—Messrs. Hall, Hunt, Lesley, Cope, Blake and Chamberlin. Among other contributors we notice the names of Daubrée, Favre, Delesse, Lapparent, Barrois, Stephanesco, Rutot, Van den Broek, Ribeiro, Almera, Szabo, etc. Many of the memoirs are of general interest and importance, *e. g.*, *Daubrée* on Experimental studies on fractures of the earth's crust; *Favre* on the effect of folds and lateral twists in geology; *Lapparent* on the plications of the Cretaceous formation between France and England; *Hall* on the nomenclature of the Palæozoic rocks of the United States; *DeMoeller*, the divisions of the Carboniferous; *Cope*, relations of horizons of extinct Vertebrata of Europe and North America; *Jannetaz* on the propagation of heat through rocks; *Hunt* on the Precambrian rocks of North America; *Ribeiro* on the geology of Portugal.

Geological News.—Mr. S. A. Miller, of Cincinnati, is publishing an important series of historical monographs of North American geology. He has concluded the Palæozoic and Mesozoic portions, and is preparing that of the Tertiaries.——Mr. M. E. Wadsworth, of Cambridge, has recently issued in the Bulletin of the Museum of Comparative Zoölogy, a series of full notes on the iron and copper districts of Lake Superior. He gives many graphic sections of vein contacts, explains the stratigraphy and reviews the literature.——Prof. Owen has recently described a new species of Theromorph reptile from the Permian bed of South Africa, under the name of *Platypodosaurus robustus*. The animal nearly resembles some of the Texan forms described by Cope in 1878.——Dr. J. W. Spencer, in the *Canadian Naturalist*, Vol. VIII, describes a number of new Graptolites from the Niagara formation. Four of them are referred to three new genera, *Calyptograpsus*, *Rhizograpsus* and *Acanthograpsus*.

GEOGRAPHY AND TRAVELS.[1]

The Franklin Search Expedition.[2]—This expedition, under Lieut. Schwatka, has returned home after a remarkably successful journey to King William Land, and the results of their investigations into the circumstances attending the loss of the memorable British company commanded by Sir John Franklin have been given at length to the world through the columns of the New York *Herald*. Lieut. Schwatka wisely lost no time in looking up the cairn on the Melville peninsula, but set out early in the spring of 1879 on his sledge journey to the scene of the great disaster. Leaving Depot island, in Hudson's bay, on April 1st, they traversed a region previously unvisited by white men, proceeding in a nearly north-westerly direction by the shortest route, to the mouth of Back's river. The party was composed of four white men and thirteen Innuits, with sleds drawn by forty-two dogs. They took with them only about one month's rations, and the success of the expedition is doubtless largely owing to their ability to live on the supplies furnished by the country. Their route should have led them across the Wager river, but at N. lat. 65° 45′ where, according to the charts, they should have been on its banks, nothing could be seen of it. They soon, however, came to an important branch of Back's river, which they followed ninety miles, leaving it near its mouth. Its whole length is 110 to 120 miles. They named it Hayes river in honor of the President. From the tribe living on this stream they heard the same account of the sinking of one of the vessels of Franklin's expedition at a point near O'Reilly's island (N. lat. 63° 30′, W. long. 95°) in the spring of 1849 as was related to Capt. Hall. On May 31st, after visiting Montreal island, they met the

[1] Edited by Ellis H. Yarnall, Philadelphia.

[2] See Naturalist for August, 1878, p. 571, and November, 1879, p. 723.

first Neitchillik encampment. Near it on an inlet west of Point Richardson a boat, skeletons and many relics had been found by the natives.

This is believed to be the furthest point reached by the remnant of Franklin's company, and here Lieut. Schwatka also believes the records of the expedition were finally lost, having been contained in a tin box which was broken open by the Esquimaux and its contents scattered to the winds.

Lieut. Schwatka first reached King William Land at the mouth of Pfeffer river, where he visited the cairn erected by Capt. C. F. Hall in May, 1869. On June 15th, the party arrived at Cape Herschell, when they left most of their men in a permanent camp. Cape Herschell was found to be about eighteen or twenty miles further west than it is given on the charts of the Admiralty. Continuing their journey along the coast they discovered the graves of two white men before reaching Collinson's inlet, and at the inlet the camp of Capt. Crozier and his command after abandoning the vessels. They found many relics here and an opened grave, the remains in which were identified by a medal found with them as those of Lieut. John Irving, third officer of the *Terror*. It is probable that Lieut. Irving was conducting a small party back to the ship for provisions after the crews had reached the southern shore of King William Land, and that the men said by the Eskimos to have drifted with the ship to O'Reilly's island, belonged to this return party. Among the ruins of a cairn was found a copy of the record discovered by Lieut. Hobson, of McClintock's expedition in Sir Leopold McClintock's handwriting, and partially illegible. This was the only document found during the journey. McClintock's record buried near the cairn was searched for but not found.

Leaving Irving bay on June 30th, they reached Cape Felix on the 3d of July. No traces of the Franklin expedition were found until three miles south of the cape, where the remains of a permanent camp were seen. A well built cairn or pillar seven feet high on a high hill two miles back from the coast was examined without finding any records. Returning down the coast a careful examination of the country within five or six miles of the coast was made, and at Point Le Vesconte the grave of an officer was found; also in the neighborhood of Erebus bay several skeletons, and in a deep inlet the remains of a very large boat.

Cenotaphs were erected wherever human remains were found. The skeletons were always incomplete and it was not always possible to tell the number of individuals represented in the piles of bones found,

The ice broke up in Erebus bay about the 1st of August. Reaching Terror bay on August 3d, the search was continued along the coast as far west as Cape Crozier, only one skeleton

being found. Lieut. Schwatka remained in King William Land until November 1st, when he started on his return trip to Hudson's bay, pursuing a route south and west of his former course, and following Back's river to 66° N. lat. This stream is laid down on the maps about one degree further west than as found by the travelers. Finding game very scarce near the river, and losing many of their dogs for want of proper food,[1] the party left the river on December 30, 1879, and traveling in a south-easterly direction through a country where plenty of game was found, arrived at Depot island on March 4, 1880.

While in King William Land two of an apparently distinct species of snipe were shot and their skins preserved for deposit in the Smithsonian Institution collection. One of them was distinguished "by a sweet simple song, somewhat similar to a lark, its silvery tones gushing forth as if in perfect ecstacy of enjoyment of sunshine and air, at the same time rising and poising itself on its wings." Small flocks of ducks—the drakes and ducks in separate bands—were also seen. "The drakes are exceedingly pretty, especially about the head and neck. The head is of a pale olive-green hue, a fashionable color in silks a few years ago, and known by the extraordinary name of 'elephant's breath.' This gradually merges into a very pale, warm gray, the line of demarkation between it and the very dark brown which constitutes the general color of the body being very abrupt. The bill is of a vermilion red, and surmounted by a bright orange colored crest with a black border as positively marked as if of black tape." "We often came," says Mr. Gilder, "upon an immense body of drakes sitting upon the edge of an ice floe, looking very much like a regiment of huzzars at a distance drawn up in line of battle. The duck is not so gaudy as her husband. She is quite contented in a full suit of mottled brown and olive-gray, presenting a texture on the back somewhat similar to the canvas back species of Chesapeake bay." Immense herds of reindeer were seen in King William Land in September, but when, about October 1st, the ice became sufficiently strong for them to cross to the mainland, they rapidly disappeared.

It is now shown that the greatest distance traversed by the members of the Franklin expedition was not much over 250 miles. All along this route the Schwatka party found game and supplies in more or less abundance, yet the crews of the *Erebus* and *Terror* evidently died from starvation. As Dr. Hayes remarks, "it does seem strange that 105 men should in so comparatively short a march have been swept out of existence and left no trace by which the history of their expedition can be read."

[1] Twenty-seven died before reaching Depot island.

The temperatures for the following months are given by Mr. Gilder:

1879, September	mean 21.1°,	minimum 5°		
October	" 0°	" —38°		
November	"—23.3°	" —49°		
December	"—50.4°	" —69°	maximum	—26°
1880, January	"—53.2°	" —71°	"	—23°
February	"—44.8°	" —69°		

January was a very stormy month there being only eleven days on which travel was possible, and the total distance passed over in that period, ninety-one miles.

The total distance traveled was 3251 miles, being very much the longest sledge journey in unexplored regions of which we have record. They were also in the field during the entire winter, so that the journey, both in distance and time, is most remarkable. Their dependence upon the resources of the country, much aided, it should be noted, by the excellence of their fire-arms, is also a distinguishing feature of the exploration. To the fact that Lieut. Schwatka and his three companions were able to live on this food is it doubtless owing that they were able to bear with impunity and even with little suffering the great cold to which they were exposed. To their diet and also to their active life throughout the whole year we must attribute their exemption from scurvy, although deprived of lime juice or any of the anti-scorbutics usually taken by similar parties. Probably also his companions possessed, alike with Lieut. Schwatka, the robust health, cheerful disposition and powers of concentration ascribed to him by Mr. Gilder. Certainly the success of this effort to reach this remote land indicate also the existence of strict discipline and thorough organization, the want of which has so often proved fatal to the success of similar attempts at exploration in these desolate regions.

It should be remembered that the results of Lieut. Schwatka's investigations entirely corroborate the statements made by Capt. Hall concerning the fate of the Franklin expedition. And especially is this the case as regards the successful accomplishment of the north-west passage by either the *Erebus* or the *Terror*.

WE REGRET to record the failure of the Howgate expedition, the *Gulnare* having returned home from Disco, being found to be unseaworthy. Dr. Parry, the naturalist of the expedition, remained in Greenland for the winter.

COL. PREJEVALSKY.—In the NATURALIST for May mention was made of the arrival of this distinguished Asiatic traveler in the province of Tsaidam on the northern frontier of Thibet. Further information received at St. Petersburg states that he had previously visited the mountainous region south of Su-chow where two snowy ranges were discovered, to which the names of Hum-

boldt and Ritter were given. He reached Koorlyk, a distance of about 180 miles, without difficulty, but had much trouble in going on to Dzoon Zassak. The distance from Saisan to Dzoon Zassak, at the foot of the Burdan Booda range, is 1370 miles. The whole country traversed, with the exception of occasional oases, is a desert, and forests were found only on the Tien-Shan. Topographical, barometrical and meteorological observations have been made, and accurate data obtained for mapping a large extent of country. From Dzoon Zassak he started for Lhassa, and after being once misled succeeded in crossing the Blue river and reaching the Tan-la plateau where a great snowy chain of mountains attains a height of 16,800 feet.

After driving off a party of nomads who attacked them the expedition reached its furthest point at the village of Nabchu, 180 miles from the capital, permission to visit Lhassa being refused by the Thibetan authorities. The return journey to Tsaidam in the midst of the violent winter storms, was very trying, and took two months. Col. Prejevalsky visited Koko-Nor and finally arrived at Si-ning on March 19th. He hopes to explore the upper course of the Yellow river and return home by way of Urga.

MICROSCOPY.[1]

USE OF COLLODION IN CUTTING THIN SECTIONS OF SOFT TISSUES.—The preparation to be cut being embedded as usual, collodion is applied to the surface of the object by means of a fine brush. The collodion is of the regular strength of the United States Pharmacopœia and should be allowed to settle so as to become as clear as water, and the clear portion decanted and reserved for use. Then after the first cut has been made with the microtome, and the superfluous alcohol removed by means of a piece of clean blotting paper free from ravelings, a small drop of collodion should be taken up with the brush and placed in the center of the object so as to allow it to flow out on all sides to prevent the formation of air bubbles. After being allowed to harden a minute, the section may be cut and placed on the slide with the film of collodion underneath. The advantage in the use of the collodion is that preparations which combine hard and soft tissues or those which are loosely connected, are held in place until the section is removed to the slide, stained and securely mounted.—*Norman N. Mason, Providence, R. I.*

THE ATWOOD CELL.—This new device, intended exclusively for mounting opaque objects, was designed by Mr. H. F. Atwood, of Rochester, and is made in hard rubber by Bausch and Lomb of that city. It consists of a black disc, hollowed at the top to contain the object, and furnished with a rim to receive the cover glass. Those now being made are adapted to half inch covers, and cost thirty cents a dozen. They can be obtained from the

[1] This department is edited by Dr. R. H. Ward, Troy, N. Y.

inventor or from the dealers in microscopical supplies. The cut gives a sectional view of this cell, the dotted line  indicating the cover glass and the open space below it the location of the object. The glass cover is easily attached by a little shellac or other suitable cement; and the whole cell may be cemented, if desired, to the center of a common glass slide. For convenience of exchanging by post, or for storing a large number of objects for future reference, in a small space, the glass slide may sometimes be omitted altogether, the name or number indicating the object being merely attached to the back of the cell.

Artificial Crystals of Gold.—In casting bars of pure gold for the manufacture of foil, traces of crystallization may often be observed upon their upper surfaces, and sometimes distinct crystalline forms. These are generally simple triangular faces slightly raised, very similar in appearance to specimens sometimes found in nature. Occasionally several faces of the octohedron may be seen, the edge in some instances being half an inch in length, and quite sharp and well defined. The purer the gold is, the more likely the crystals are to form, and they are oftenest seen when the bars are cast from that which has been previously crystallized by the battery process described below. * * *

The precipitation of gold from solution by the aid of a battery is a well-known process in the common operation of electro-gilding, but to deposit it in the crystalline form is a process of comparatively recent date, having been patented in 1860 as a method of preparing gold for dental purposes. The process is briefly as follows: A solution of chloride of gold and ammonium is placed in a shallow dish coated with heavy gold foil, which is connected with the zinc plate of a large Daniels' battery. Near the top of the solution and connected with the copper plate of the battery, a roll made up of thin strips of pure gold is suspended, enclosed in a muslin bag. The strength of the battery current is controlled by a coil of wire arranged as a rheostat, a clamp terminating one of the battery wires enabling the operator to include a greater or less number of coils in the circuit. The necessary conditions being fulfilled, on completing the circuit the gold is gradually dissolved from the roll and deposited on the bottom of the dish in bright crystalline flakes having the appearance of feathers or fern leaves when examined under the microscope. * * * I have been quite surprised that no trace of faces is to be observed upon these crystals, as is always the case with natural ones. The latter are seen under a low power to be made up of strings of distorted isometric crystals which are often so distinct that they can be measured. The artificial ones do not show this structure, and when magnified to three hundred diameters only show a slightly beaded look along the side ribs, but nothing that can be considered distinct crystalline forms. With the power

mentioned the whole surface of each crystal is in focus at once, showing that the different sets of ribs are in the same plane. Where one crystal lies upon another, when examined under a power of a hundred and fifty diameters, both are in focus at once, showing that they are exceedingly thin and lie perfectly flat. * * *

If a film of amalgam is allowed to form on the surface of a piece of pure gold, and the mercury be then driven off by heat, traces of crystallization may sometimes be observed, a network of indistinct crystals remaining. To accomplish this the gold should be perfectly pure, and the heat applied very gently at first. With the greatest pains, however, the result is not always, or even often, satisfactory. The surface is generally left in an amorphous condition, or at best covered with angular depressions. Very rarely, and under conditions not fully understood, the crystallization is distinct enough to be recognized as such. But distinct though minute crystals of gold amalgam may easily be obtained if the mercury is dissolved out with dilute nitric acid instead of being driven off by heat.—*A. H. Chester in Am. Jour. Sci. and Arts.*

Angular Aperture.—Dr. Geo. E. Blackham's paper on this subject, read at the Microscopical Congress at Indianapolis, has been published by the Industrial Publication Company of New York. The paper presents a comprehensive review, in a popular rather than a mathematical style, of the subject of the angular aperture of microscopic objectives. It is neatly published in an attractive form, and extensively illustrated with optical diagrams. and it will be a convenient and welcome addition to the libraries even of those most familiar with the somewhat trite subject.

Sweating of Microscopic Slides. — Not long ago a well-known optician showed to me a spoiled "podura" slide. The scales were very good and large—in fact, it was a slide which I had given to him, and it had been selected by myself in Beck's establishment in London as unexceptionally fine. This slide began slowly to show symptoms of "sweating." One scale after another appeared as though moisture had, in some mysterious way, penetrated to the objects; it was not water, however, for when the cover, after much trouble, had been removed, and warmed sufficiently to evaporate anything like water, the scales still exhibited the same appearance, and, in fact, the heat required to get rid of this apparent moisture was so great that the scales were charred. When wax rings are used, this apparent wetting or "sweating" occurs quickly, and more disagreeable than this, innumerable elongated specks, possibly crystalline, appear all over the under surface of the cover-glass. The same trouble occurs when any of the ordinary asphalt preparations are used, and the only cement which I have thus far found to be tolerably

successful is shellac thoroughly incorporated with the finest carbon (diamond black) such as is used in the preparation of the best printing inks; the solvent being alcohol, these rings dry rapidly, and the cover is attached by heating. Even these rings cannot be trusted unless thoroughly dry, and spontaneous drying is better than baking. I have had preparations spoiled after mounting on asphalt rings which had been made for over a year, and which had been subjected for several hours to the heat of a steam bath. With large, somewhat coarse objects, the defect is not so marked, but with delicate ones, and especially test objects, it is simply a nuisance. With care I think the shellac rings may answer pretty well. I have not tried the aniline colored rings. The moisture (whatever it is) and the crystalline specks appear to be derived from the vaporizable parts of the wax or cement given off under conditions where one would suppose such a thing impossible; it is however a fact; I have the proof of it, and I dare say hundreds of others have, too plainly evident. There is another mode of making cells which promises well for permanence. My attention was first called to this method by Dr. Tulk, of London, who suggested for this purpose the thin gutta-percha tissue used by surgeons in the place of oiled silk. I have had special punches made which cut neat rings from this tissue, and I have used these rings with the greatest satisfaction. I have no preparation of my own more than two years old, these, so far, show no signs of change. Dr. Tulk informs me that he has them ten years old, and still good as when new. I have noticed that in some recent papers in the microscopical journals the writers who, with little experience, have so lauded wax rings, speak of "thin rubber" for rings. Evidently they have seen somewhere the gutta-percha mount, and supposed it rubber—the latter will not answer, melted rubber will not become hard. One beauty of the gutta-percha ring is the very moderate heat required; it is thus available for many objects which might be injured by the greater heat necessary for the asphalt or shellac rings. As these rings, the arrangement of which I have spoken of, can be rapidly made, and as they can be kept for any length of time (shut away from the dust), they are at any moment ready as well as convenient for use. The preparation is first arranged, dried or burnt on the cover, the slide cleaned, a ring laid on the center, and on this the cover is placed; the whole is now held together by the forceps and *slightly* warmed, just sufficient to soften the gutta-percha; the forceps may now be laid aside, or used simply to press the cover home, warming the slide gently, also the cover; the perfect contact of the softened "tissue" with the cover and slide is easily recognized, and with a little care this can be effected very quickly, and nothing further is necessary. A finishing ring of colored cement makes a very neat mount, but it is not necessary.—*Prof. H. L. Smith, in "Science."*

SCIENTIFIC NEWS.

— The fiftieth meeting of the British Association for the Advancement of Science was held at Swansea, beginning August 26th. The inaugural address of the president, Prof. A. C. Ramsay, was on the recurrence of certain phenomena in geological time. It was a contribution to the doctrine of uniformitarianism. He claimed that the deposition of the Laurentian rocks took place far from the beginning of recognized geological time; that the phenomena of metamorphism extend from that date all through the later formations down to and including part of the Eocene strata; that volcanic forces played no more important part in any period of geological time than in our modern epoch, that the formation of mountain chains has gone on with increasing vigor from before the deposition of Silurian rocks to Pliocene times; that the deposition of salts from aqueous solutions in inland lakes and lagoons appears to have taken place through all time; that glacial phenomena began with the Cambrian epoch. He concludes, therefore, that the earliest of the physical events alluded to by him were so enormously removed from the primitive events assumed by the nebular hypothesis, "that they appear to me to have been of comparatively quite modern occurrence, and to indicate that from the Laurentian epoch down to the present day all the physical events in the history of the earth have varied neither in kind nor in intensity from those of which we now have experience." The address of H. C. Sorby, president of the section of geology, was on the comparative structure of artificial slags and erupted rocks, there being a gradual passage from one type to the other. The address of Dr. Günther, president of the section of biology, was on museums, with especial reference to the British Museum. The address of Mr. Balfour in the department of Anatomy and Physiology, was on recent progress in embryology, and is a valuable résumé of our present knowledge of the origin of the different anatomical systems of the animal body, with especial reference to the genesis of the nervous system.

— A London paper of recent date gives the following particulars of an extraordinary match at rat killing. "Hollinwood, near Manchester, was the scene of a rather novel rat-killing match the other day, between Mr. Benson's fox terrier dog, Turk, and a Mr. Lewis's monkey, for £5. The conditions of the match were that each one had to kill twelve rats, and the one that finished them the quickest to be declared the winner. You may guess what excitement this would cause in the 'doggy' circle. It was agreed that Turk was to finish his twelve rats first, which he did, and in good time, too, many bets being made on the dog after he had finished them. After a few minutes had elapsed it now came the monkey's turn, and a commotion it caused. Time being called, the monkey was immediately put to his twelve rats, Mr.

Lewis, the owner, at the same time putting his hand in his coat pocket and handing the monkey a peculiar hammer. This was a surprise to the onlookers; but the monkey was not long in getting to work with his hammer, and, once at work, he was not long in completing the task set before him. You may talk about a dog being quick at rat-killing, but he is really not in it with the monkey and his hammer. Had the monkey been left in the ring much longer you could not have told that his victims had been rats at all—he was for leaving them in all shapes. Suffice it to say the monkey won with ease, having time to spare at the finish. Most persons present (including Mr. Benson, the owner of the dog) thought the monkey would worry the rats in the same manner as a dog does; but the conditions said to kill, and the monkey killed with a vengeance, and won the £5, besides a lot of bets for his owner.

— The French Government has, according to *Nature*, during the past summer carried on deep sea explorations in the Bay of Biscay in the steamer *Travailleur*, of 900 tons. The naturalists of the expedition were M. A. Milne-Edwards and Profs. Marion and Perier; Messrs. J. Gwyn-Jeffreys and A. Norman, of England, being present by invitation. Twenty-three dredgings were made at depths ranging from 337 to 2600 mètres. Those between 600 and 1000 fathoms were the most important. Nearly every class of invertebrates was represented; novelties being discovered in Mollusks, Crustacea, Echinoderms, Annelides, Actinozoa and sponges. A submarine valley was found to exist within a few miles of the coast, opening from the Fosse de Cap Breton and extending to a point opposite Cap Penas. The zoölogical results of this expedition, says Mr. Jeffreys, are fully equal in importance to those made by Capt. Baudon in 1801, M. d'Urville in 1829, the *Recherche* in 1835, the *Astrolabe* in 1841 and other French expeditions.

— We are glad to announce to our readers that Prof. Chas. E. Bessey, of Iowa Agricultural College, has kindly consented to edit the Department of Botany of the AMERICAN NATURALIST. Prof. Bessey is the author of the Botany for High Schools and Colleges, one of Holt's American Science Series, and was late Lecturer on Botany in the University of California. We feel sure that the magazine will greatly profit by this addition to its editorial force, and would ask botanists to lend him all possible assistance.

— The French Association met the last week in August at Rheims, about 500 members being present, exclusive of local members. The address of M. Perier on transformism was to the end that the doctrine of evolution was a scientific mistake, though its first advocate, Lamarck, was a Frenchman.

— It appears that the surgeon of the ill-fated *Atlanta*, which is

supposed to have foundered at sea, was Dr. E. L. Moss, a good observer of nature, who contributed some excellent papers on marine animals to the publications of English scientific societies, and withal was an excellent artist.

— Augustin Seguin and Jules Luquet, two eminent civil engineers from Lyon, France, are now visiting the Yellowstone National Park. Within two years a railroad will be completed which will render this park very accessible.

— A list of preparations of Phylloxera, its natural enemies and of other insects living on the vine, has been published by Dr. Adolph Blankenhorn, of Karlsruhe.

— The Italian Government has recently made the liberal appropriation of 1,000,000 lire for a Geological Survey of Italy.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

ACADEMY OF NATURAL SCIENCES, Philadelphia, March 16.—Mr. J. A. Ryder described *Trichopetalum lunatum*, and spoke on Podophrys and Epistylus; he also described *Camaraphysema obscura*. Mr. Potts spoke on Vorticella.

March 23.—Dr. H. C. Chapman remarked on the generative apparatus of Elephas. Mr. Ryder described a new order of myriapods, Symphyla.

March 30.—Mr. Ryder spoke farther on Symphyla. Mr. Meehan on advancement of vegetation. Dr. H. Allen on the olfactory sense in mammals. Mr. Ryder on Epistylis. Mr. Potts on Vorticella.

April 13.—Dr. Jos. Leidy remarked on Entomostracans and Infusoria in ponds near Woodbury, N. J. Mr. Meehan on Sarcodes.

April 20.—Mr. J. S. Kingsley spoke on cell division.

April 27.—Mr. H. C. McCook remarked on honey ants. Mr. Jos. Willcox on the habits of the blue heron.

May 4.—Mr. McCook remarked on honey ants. Mr. Isaac Martindale on parasitic plants. Mr. Potts on Spongilla.

May 11.—Prof. Pike spoke on fossil impressions supposed to have been made by jelly fishes. Mr. Ford on eggs of mollusks.

May 18.—Dr. Chapman spoke on the anatomy of the orang-outang. Messrs. Ford and Potts on the nidus of Natica.

May 25.—Dr. A. J. Parker spoke on the brain of the chimpanzee.

June 1.—Mr. J. A. Ryder described a species of Japyx. Prof. S. S. Haldeman spoke on stone implements. Mr. Edw. Potts remarked on the embryo of Natica.

June 8.—Dr. Francis Dercum spoke on the lateral lines in fishes. Mr. E. Potts on the anatomy of pipe fish.

June 29.—Dr. Allen on Bunodont teeth. Dr. Foote on caverns near Louray, Va.

July 27.—Mr. Edw. Potts made some remarks on sponges.

August 3.—Mr. Potts on larva of flies. Mr. Meehan spoke on "sleep of plants."

September 7.—Dr. Herman Evarts spoke on Infusoria. Dr. Foote on a large specimen of Sphene. Mr. Potts on Plumatella.

September 14.—Dr. Evarts spoke on Infusoria and described *Freia cærulea*. Mr. Meehan on the limit of vegetation in the Rocky mountains. Mr. Potts on tubers. Mr. Meehan on nesting of birds.

September 21.—Dr. Leidy spoke on organic remains discovered in Hartman's cave. Prof. Porter on organic life and vegetation. Mr. Meehan on dimorphism in plants.

The following papers have been presented for publication: March 16.—"Carcinological Notes, No. IV," by J. S. Kingsley. March 23.—"On the Gestation and Generative Apparatus of the Elephant," by Dr. H. C. Chapman. "On a new species of Hemitripterus from Alaska," by W. N. Lockington. April 13.—Description of a new species of Catostomus *(C. cypho)* from the Colorado river," by W. N. Lockington. May 18.—"On the Structure of the Orang-outang," by Dr. H. C. Chapman. June 1.—"Description of a Partula, supposed to be new, from the Island of Moorea," by W. D. Hartmann, M.D. June 8.—"On the development of *Lemna minor*," by Wm. Barbeck. June 15.—"A bibliographical catalogue of the genus Partula, with observations on the species," by W. D. Hartmann, M.D. August 17.—"Rhizopods in the mosses of the summit of Roan mountain, N. C.," by Jos. Leidy, M.D.

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SELECTED ARTICLES IN SCIENTIFIC SERIALS.

ZEITSCHRIFT FUR WISSENSCHAFTLICHE ZOOLOGIE.—July 30. On a peculiar formation of the dorsal vessel in some Ephemerid larvæ, by O. Zimmermann. Contributions to a knowledge of the Gephyrea, by J. W. Spengel.

THE GEOLOGICAL MAGAZINE.—September. Oceans and Continents, by T. M. Reade. The mammoth in Siberia, by H. H. Howorth.

JENAISCHE ZEITSCHRIFT FUR NATURWISSENSCHAFT.—August 15. On the structure of the Ctenophora, by R. Hertwig (an elaborate histological essay with six plates). On the doctrine of cell structure, by C. Frommann.

ANNALES DES SCIENCES NATURELLES.—June, July. Anatomical researches on the Bullidæ, by M. Vayssière (an elaborate and well illustrated treatise on these mollusks).